88273R02
VOLUME II
2nd COPY

CONCEPTUAL DESIGN ANALYSIS NORTHWEST BOUNDARY CONTAINMENT/ TREATMENT SYSTEM ROCKY MOUNTAIN ARSENAL COMMERCE CITY, COLORADO FY 82 MCA LINE ITEM 37 DACA 45-82-C-0064

VOLUME II

Prepared By

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Project No.
C-26616

16 July 1982

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	07/16/82	

4. TITLE AND SUBTITLE
CONCEPTUAL DESIGN ANALYSIS, NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM, ROCKY MOUNTAIN ARSENAL, COMMERCE CITY, CO, FY82

5. FUNDING NUMBERS

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

STEARNS-ROGER ENGINEERING CORPORATION
DENVER, CO

8. PERFORMING ORGANIZATION REPORT NUMBER

88273R02

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

THE PURPOSE OF THIS CONCEPT DESIGN ANALYSIS IS TO DEFINE THE FOLLOWING FOR THE NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM:

1. FUNCTIONAL AND TECHNICAL REQUIREMENTS
2. BUILDING AND EQUIPMENT REQUIREMENTS
3. SUPPORT SYSTEMS.

SPECIFICATIONS ARE INCLUDED FOR THE FOLLOWING ELEMENTS:

1. CARBON TREATMENT SYSTEM
2. SITE DEVELOPMENT - GRADING AND PLACEMENT
3. BUILDING DETAILS - WALLS, FLOORS, ETC.
4. STRUCTURAL DETAILS - STEEL AND FOUNDATIONS
5. MECHANICAL - PLUMBING AND PIPES
6. ELECTRICAL.

VOLUME II CONTAINS COST ESTIMATES AND DESIGN CALCULATIONS.

14. SUBJECT TERMS

SANITARY SEWER, COST, CONSTRUCTION, EQUIPMENT, SPECIFICATIONS

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

Stearns-Roger

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NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM

VOLUME I

(Continued)

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CONCEPT DESIGN ANALYSIS
NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM

VOLUME I
(Continued)

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CONCEPT DESIGN ANALYSIS
NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM

VOLUME I
(Continued)

SECTION 5 - STRUCTURAL (continued)

SECTION 6 - MECHANICAL

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CONCEPT DESIGN ANALYSIS
NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM

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CONCEPT DESIGN ANALYSIS

NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM

VOLUME II

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CRAFT WAGE RATES
(Denver Area)

TRADE	Rate Per Hr.	Health & Welfare	Pension	Vacation	App. Train.	Other	Average PT&I	Total Per Hr.
Carpenters	14.87	1.20	.85	1.00	.11		3.56	21.59
Electricians	17.85	.34	1.25		.06(2)	.58(1)	3.96	24.04
Pipe Fitters/ Plumbers	16.82	1.00	1.50	1.00	.08		4.02	24.42
Laborer	10.23	1.04	.70	.75	.10	.05(3)	2.54	15.41
Operating Engrs. Group 5	13.90	1.19	1.20	.60	.12	.05(4)	3.36	20.42
Millwrights	16.76	1.20	1.00		.29		3.80	23.05
Ironworkers	16.55	1.19	1.35		.17		3.80	23.06
Cement Masons	15.69	1.04	1.35		.13	.05(4)	3.60	21.86
Painter	15.61	.91	1.15		.08	1.42(5)	3.79	23.00

Notes:

(1) NEBF = 3% of Gross.
(2) Apprentice Training = 0.03% of Gross.
(3) Industry Promotion.
(4) Construction Advancement Program.
(5) Estimated Increase for 1982 - 8%.

PTI Average For Denver Area For
The Above Crafts = 19.72018%

(0520N)

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-16-82	SHEET 1 OF 2

PROJECT: NW BOUNDARY CONTAINMENT/TREATMENT
LOCATION: ROCKY MT ARSENAL
ARCHITECT ENGINEER: STEARNS - ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.: | ESTIMATOR: A. LeBel | CHECKED BY: JHC

BUILDING SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
BUILDING							
SUB CONT							64300
PRE-ENGRD. METAL BLDG							
G/C OVERHEAD 10%							6430
G/C PROFIT 5%							3537
TOTAL ▷							14267
ARCHTL							2748
G/C OVERHEAD 20%							550
G/C PROFIT 10%							330
TOTAL ▷							3628
STRUCTURAL							63537
G/C OVERHEAD 20%							12717
G/C PROFIT 10%							7630
TOTAL ▷							83934

CONSTRUCTION COST ESTIMATE

DATE PREPARED

SHEET 2 OF 2

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
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- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR

CHECKED BY

BUILDING SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
MECHANICAL							97740
SUB/CONT-OVERHEAD 20%							19948
SUB/CONT-PROFIT-10%							11729
S/C TOTAL							129016
G/C. OVERHEAD-10%							12901
G/C PROFIT-5%							7096
TOTAL D							149013
ELECTRICAL							35447
SUB/CONT OVERHEAD 16%							5951
SUB/CONT PROFIT 10%							4140
S/C. TOTAL A.							45538
G/C OVERHEAD-10%							4554
G/C PROFIT -5%							2505
TOTAL							52597

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-16-82	SHEET 1 OF 2

PROJECT: NW BOUNDARY CONTAINMENT/TREATMENT

LOCATION: ROCKY MT ARSENAL, COLO

ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE
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- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR: A. LeBEL

CHECKED BY: JHL

SUPPORT UTILITIES SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUPPORT UTILITIES							
BUILDING EXCAVATION				131		151	282
S/C OVERHEAD 20%							56
S/C PROFIT 10%							35
S/C - TOTAL							373
G/C OVERHEAD 10%							37
G/C PROFIT 5%							21
TOTAL ▷							431
FUEL SYST. PROPANE				1218		1969	3187
S/C OVERHEAD 20%							637
S/C PROFIT 10%							382
S/C - TOTAL							4206
G/C OVERHEAD - 10%							421
G/C PROFIT - 5%							231
TOTAL ▷							4858

* U.S. GOVERNMENT PRINTING OFFICE 1959 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED

SHEET 2 OF 2

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A *(No design completed)*
- ☒ CODE B *(Preliminary design)*
- ☐ CODE C *(Final design)*
- ☐ OTHER *(Specify)*

DRAWING NO.

ESTIMATOR

CHECKED BY

SUPPORT UTILITIES SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUPPORT UTILITIES (CONT)							
SANITARY SYSTEM.				890		1913	2803
S/C OVERHEAD 20%							561
S/C PROFIT 10%							336
S/C TOTAL							3700
G/C OVERHEAD 10%							370
G/C PROFIT 5%							204
TOTAL							4274

ENG FORM 1 AUG 59 150 (ER 1110-345-730) PREVIOUS EDITION MAY BE USED (TRANSLUCENT)

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CONSTRUCTION COST ESTIMATE

DATE PREPARED: 7/14/82 | SHEET 1 OF 1

PROJECT: NORTHWEST BOUNDARY/CONTAINMENT TREATMENT SYSTEM

LOCATION: ROCKY MOUNTAIN ARSENAL

ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE:
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.:

ESTIMATOR: REH/SDC

CHECKED BY: JHL

PROCESS SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT MH	LABOR TOTAL $	MATERIAL PER UNIT $	MATERIAL TOTAL $	TOTAL COST
PROCESS EQUIPMENT							
RAW WATER FEED PUMPS	4	EA	32	$3,126	5,332	$21,329	$24,454
RAW WATER PREFILTERS	6	EA	16	$2,344	4,780	$28,680	$31,024
ADSORPTION SYSTEM EQUIP.	3	EA	136	$9,964	—	$638,000	$647,964
BOOSTER PUMP	1	EA	32	$781	—	$2,800	$3,581
POST FILTER	1	EA	32	$781	—	$70,133	$70,914
AIR COMPRESSOR	1	EA	36	$879	—	$2,800	$3,679
TOTALS				17,875		763.741	781.616
GC OVERHEAD 10%							78.161
GC PROFIT 5%							42,988
TOTAL							902,765
TOTAL							

ENG FORM 150
1 AUG 59

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CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET 1 OF 4

PROJECT: N.W. BOUNDARY GROUND WATER CONTROL SYSTEM
LOCATION: ROCKY MOUNTAIN ARSENAL - COMMERCE CITY, CO
ARCHITECT ENGINEER: STEARNS-ROGER 26616

BASIS FOR ESTIMATE: ☐ CODE A (No design completed) ☒ CODE B (Preliminary design) ☐ CODE C (Final design) ☐ OTHER (Specify)

DRAWING NO.: | ESTIMATOR: STEVE V.W. | CHECKED BY:

ARCHITECTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Pre engineered Metal	1			Sub-contract			$64,300.00
Bldg 40x72'-8x30' eave							
(see Manufacturer							
confirmation letter)							
TOILET ROOM							
· 6" Reinforced block	120	SF	21.86/HR	$546.50	$1.00/SF	$120.00	$666.50
wall 14LF x 8'-H - 3'0" door	25	HR					
· Door 2'8"	1	ea	21.59/HR	$64.77	$105/ea	$105.00	$169.77
	3	HR					
· Door hardware	1	set	21.59/HR	$21.59	$110/set	$110.00	$131.59
	1	HR					
· Lavatory	1	ea	24.42/HR	$73.26	$125/ea	$125.00	$198.26
	3	HR					
· Soap Dispenser	1	ea	21.59/HR	$10.80	$24/ea	$24.00	$34.80
	.5	HR					
· Mirror	1	ea	21.59/HR	$10.80	$46/ea	$46.00	$56.80
	.5	HR					
· Toilet Paper Dispenser	1	ea	21.59/HR	$10.80	$14/ea	$14.00	24.80
	.5	HR					
· Paper Towel Dispenser	1	ea	21.59/HR	$10.80	$25/ea	$25.00	35.80
	.5	HR					
· Trash Container	1	ea	15.41/HR	$7.70	$15/ea	$15.00	$22.70
	.5	HR					
Drinking Fountain	1	ea	24.42/HR	$48.84	265/ea	$265.00	313.84
	2	HR					
EMERG. EYE WASH & SHOWER	1	ea	24.42/HR	$48.84	335/ea	$335.00	383.84
	2	HR					
sub-total				854.70		$1184.00	2038.70
+ Subcontract							
TOTAL							$66,338.70

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET 2 OF 4

PROJECT: N.W. BOUNDARY GROUND WATER CONTROL SYSTEM
LOCATION: ROCKY MOUNTAIN ARSENAL, COMMERCE CITY, CO
ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
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- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.: | ESTIMATOR: STEVE V.W. | CHECKED BY:

ARCHITECTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Painting							
· Block wall	240 / 6	SF / HR	23.00/HR	$138.00	.14/SF	$33.60	$171.60
· Doors 4 doors x 2 sides	8 / 4	ea / HR	23.00/HR	$92.00	2.16/ea	$17.28	109.28
· Plywood 50SF x 2	1.00 / 4	SF / HR	23.00/HR	$92.00	.16/SF	$16.00	108.00
Metal studs 6" @ 24" o.c.	50 / 2	SF / HR	21.59/HR	$43.18	.71/SF	$35.50	78.68
Clip angle L3x3x1/4	1 / 1	ea / HR	23.06/HR	$23.06	5.00/ea	$5.00	28.06
Plywood decking 3/4" A-C	2 / 2	SHTS / HR	21.59/HR	$43.18	25/SHT	$50.00	93.18
Plywood ceiling 1/2" A.C.	2 / 2	SHTS / HR	21.59/HR	$43.18	23/SHT	$46.00	89.18
6" Batt Fiberglass Ins.	50 / 1	SF / HR	21.59/HR	21.59	.29/SF	$10.00	31.59
TOTAL				$496.19		$213.38	$709.57

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET 3 OF 4

PROJECT: N.W. BOUNDARY GROUND WATER CONTROL SYSTEM
LOCATION: ROCKY MOUNTAIN ARSENAL - COMMERCE CITY, CO
ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.: | ESTIMATOR: STEVE V. W. | CHECKED BY:

ARCHITECTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Sewage Disposal							
• Septic Tank - 500 gal	1/4	eq HR	20.42/HR	81.68	220/eq	$220.00	$301.68
excavation	2	HR	20.42/HR	40.84	—	—	40.84
backfill	2	HR	20.42/HR	40.84	—	—	40.84
• Dosing Tank	1/4	eq HR	20.42/HR	81.68	200/eq	$200.00	$281.68
excavation	2	HR	20.42/HR	40.84	—	—	40.84
backfill	2	HR	20.42/HR	40.84	—	—	40.84
• Trench							
4" clay pipe	25/4	LF HR	24.42/HR	97.68	1.60/LF	$40.00	$137.68
excavation	2	HR	20.42/HR	40.84	—	—	40.84
backfill	2	HR	20.42/HR	40.84	—	—	40.84
• Distribution box	1/4	eq HR	20.42/HR	81.68	150/eq	$150.00	$231.68
excavation	2	HR	20.42/HR	40.84	—	—	40.84
backfill	2	HR	20.42/HR	40.84	—	—	40.84
• Leaching Field							
perforated PVC pipe	140/4	LF HR	24.42/HR	97.68	1.00/LF	$140.00	$237.68
excavation 36'x20'x1'	2	HR	20.42/HR	40.84	—	—	40.84
backfill w/gravel	720/2	SF HR	20.42/HR	40.84	.24/SF	$172.80	213.64
backfill covering	2	HR	20.42/HR	40.84	—	—	40.84
• Backhoe rental	2	DAY		—	495/DAY	$990.00	990.00
3/4 CY							
				$889.64		$1912.80	$2802.44

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET 4 OF 4

PROJECT: N.W. BOUNDARY GROUND WATER CONTROL

LOCATION: ROCKY MOUNTAIN ARSENAL - COMMERCE CITY, CO

ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE: ☐ CODE A (No design completed) ☒ CODE B (Preliminary design) ☐ CODE C (Final design) ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: STEVE V.W.

CHECKED BY

~~ARCHITECTURAL~~ SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
Summary Sht							
Sheet 1				$854.70		$1184.00	2038.70
+ Subcontract $64,300							64,300.00
Sheet 2				$496.19		213.38	$ 709.57
Sheet 3			×	$889.64		$1912.80	2,802.44
TOTAL				2,240.53		3,310.18	$69,850.71
PREENGINEERED BLDG.				—		—	$64,300.00
TOILET ROOM				$931.21		$739.50	1,661.71
× SEWAGE SYSTEM				889.64 ✓		$1912.80 ✓	2,802.44
DRINKING FOUNTAIN				48.84 ✓		$265.00 ✓	313.84
EMERG. EYE WASH & SHOWER				48.84		$335.00	383.84
PAINTING				322.00 ✓		$ 66.88 ✓	388.88
				$2,240.53		$3310.18	
TOTAL							$69,850.71

* U.S. GOVERNMENT PRINTING OFFICE : 1958 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 7-12-82 | SHEET 1 OF 5

PROJECT: GROUND WATER TREATMENT FACILITY

LOCATION: ROCKY MOUNTAIN ARSENAL

ARCHITECT ENGINEER: STEARNS ROGER ENGINEERING 26616 82

BASIS FOR ESTIMATE:
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.:

ESTIMATOR: G. J. WHITTALL.

CHECKED BY:

STRUCTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
EXCAVATION:						EQUIPMENT.	
TRENCHES & GRADE BM's	78.5	C.Y.			1.02	$80.07	80.07
	3.5	MH	15.41	$53.94			53.94
BLDG FOUNDS & EQUIPMENT	54	CY			1.02	$55.08	55.08
	3.0	MH	15.41	$46.23			46.23
FLOOR & DOORWAYS	37.0	CY			0.43	$15.91	15.91
	2.0	MH	15.41	$30.82			30.82
	SUB TOTAL			130.99		151.06	282.05
BACKFILL:							
TO FOUNDATIONS ETC	72	CY			1.37	$98.64	98.64
	2	MH	15.41	$30.82			30.82
STRUCTURAL BACKFILL	58	CY			6.50	$377.00	377.00
	17.5	MH	15.41	$269.68			269.68
VAPOR BARRIER							
4 MILS P.V.C.	3708	SF			1.80	$6674.40	6,674.40
	8	MH	15.41	$123.28			123.28
CONCRETE: f'c 3000							
COMPLETE WITH FORMS							
& REBAR							
FLOOR SLAB	26.0	CY			58.00	$1508.00	1,508.00
	34.0	MH	21.86	$743.24			743.24
EQUIPMENT FOUNDS	44	CY			65.00	$2860.00	2860.00
	129	MH	21.86	$2819.94			2819.94
DOOR PADS	7.5	CY			58.00	$435.00	435.00
	10.0	MH	21.86	$218.60			218.60

ENG FORM 150
1 AUG 59

PREVIOUS EDITION MAY BE USED

4,336.55 12,104.10 16,440.65

* U.S. GOVERNMENT PRINTING OFFICE 1959 O—515148

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-12-82	SHEET 2 OF 5

PROJECT: GROUND WATER TREATMENT FACILITY
LOCATION: ROCKY MOUNTAIN ARSENAL
ARCHITECT ENGINEER: STEARNS ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
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- ☐ OTHER (Specify)

DRAWING NO.
ESTIMATOR: G. J. WHITTALL
CHECKED BY

STRUCTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
CONCRETE (CONT)							
BUILDING FOUND'S	8.1	CY			71.00	$575.10	575.10
	32	MH	21.86	$699.52			699.52
GRADE BM'S & TRENCHES	53	CY			102.00	$5,406.00	5,406.00
	440	MH	21.86	$9618.40			9,618.40
GROUT 1" THICK	12.5	SF			3.50	$ 43.75	43.75
	3.0	MH	21.86	$ 65.58			65.58
GROUT 2" THICK	708	SF			7.00	$4956.00	4,956.00
	227	MH	21.86	$4962.22			4,962.22
EXPANSION AND							
ISOLATION JOINTS	498	LF			0.54	$ 268.92	268.92
	11	MH	21.59	$ 237.49			237.49
JOINT FILL	498	LF			0.17	$ 84.66	84.66
	9	MH	21.59	$194.31			194.31
STEELWORK.							
CURB L FOR TRENCHES	240	LF			3.05	$ 732.00	732.00
	24	MH	23.06	$ 553.44			553.44
GRATING							
FOR TRENCHES 1/4 THICK	276.5	SF			6.85	$1894.03	1,894.03
	11.0	MH	23.06	$ 253.66			253.66
FOR WALKWAYS 1" THICK	312.5	SF			4.50	$1406.25	1,406.25
	22	MH	23.06	$ 507.32			507.32
ACCESS LADDERS	86	LF			25.00	$2150.00	2,150.00
NO CAGE	33	MH	23.06	$ 760.98			760.98

ENG FORM 150
1 AUG 59
PREVIOUS EDITION MAY BE USED

17,852.92 17,516.71 35,369.63 ✓

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CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-12-82	SHEET 3 OF 5

PROJECT: GROUND WATER TREATMENT FACILITY
LOCATION: ROCKY MOUNTAIN ARSENAL
ARCHITECT ENGINEER: STEARNS ROGER

BASIS FOR ESTIMATE
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- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.
ESTIMATOR: G. J. WHITTALL
CHECKED BY

STRUCTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
STEELWORK (CONT)							
HANDRAIL & KICK PL	230	LF			22.00	$5060.00	5,060.00
	37	MH	23.06	$853.22			853.22
ANCHOR BOLTS							
1" ϕ x 18" LONG	40	EA			3.60	$144.00	144.00
	22	MH	21.59	$474.98			474.98
1" ϕ x 24" LONG	16	EA			4.25	$68.00	68.00
	10	MH	21.59	$215.90			215.90
3/4" ϕ x 18" LONG	24	EA			2.35	$56.40	56.40
	10	MH	21.59	$215.90			215.90
EXPANSION BOLTS							
3/4" ϕ x 7" LONG	16	EA			3.80	$60.80	60.80
DRILLING	16	EA			0.47	$7.52	7.52
	5	MH	21.59	$107.95			107.95
STEEL FRAMING TO							
WALKWAYS	4402	LBS			0.60	$2641.20	2641.20
	75	MH	21.59	$1619.25			1619.25
				3,487.20		8,037.92	11,525.12

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-13-82. SHEET 4 OF 5

PROJECT: GROUND WATER TREATMENT FACILITY

LOCATION: ROCKY MOUNTAIN ARSENAL

ARCHITECT ENGINEER: STEARNS ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: G J. WHITTALL

CHECKED BY

STRUCTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SLAB FOR PROPANE STORAGE TANK:							
						EQUIPMENT	
EXCAVATION:	4	C.Y.			1.02	$4.08	4.08
	ONE	MH	15.41	$15.41			15.41
STRUCTURAL BACKFILL	1.33	CY			6.50	$8.65	8.65
	ONE	MH	15.41	$15.41			15.41
VAPOR BARRIER 4 MILS P.V.C	72	S.F.			1.80	$129.60	129.60
	ONE	MH	15.41	$15.41			15.41
CONCRETE fc' 3000	2.67	CY			65.00	$173.55	173.55
COMPLETE WITH FORMS & REBAR	7.85	MH	21.86	$171.66			171.60
TOTALS:				$217.84		$315.88	$533.77

ENG FORM 150
1 AUG 59

PREVIOUS EDITION MAY BE USED

* U.S. GOVERNMENT PRINTING OFFICE 1958 O—516145

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-12-82	SHEET 5 OF 5

PROJECT: GROUND WATER TREATMENT FACILITY
LOCATION: ROCKY MOUNTAIN ARSENAL
ARCHITECT ENGINEER: STEARNS ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: G.J. WHITTALL

CHECKED BY

STRUCTURAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
TOTALS							
SHEET 1				$4336.55		12,104.10	$16,440.65
SHEET 2				$17852.92		17,516.71	$35,369.63
SHEET 3				$3487.20		8,037.92	$11525.12
SHEET 4				217.89		315.88	533.77
				25,894.56		37,974.61	63,869.17
EXCAVATION FROM PG 1				130.99		151.06	282.05
NET STRUCTURAL				25,763.57		37,823.55	63,587.12

ENG FORM 150
1 AUG 59

PREVIOUS EDITION MAY BE USED

* U.S. GOVERNMENT PRINTING OFFICE 1959 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-8-82 | SHEET 1 OF 3

PROJECT: NW BOUNDARY TREATMENT FACILITY

LOCATION: ROCKY MTN. ARSENAL, DENVER COLO.

ARCHITECT ENGINEER: STEARNS-ROGER 26616

BASIS FOR ESTIMATE:
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: TKC

CHECKED BY: JMC

HVAC SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL # PER UNIT	MATERIAL # TOTAL	TOTAL COST
PROPANE UNIT HEATERS	4	EA	4	16	480	1920.-	
33,000 BTUH CAP. EA.							
(MODINE PA-50)							
THERMOSTAT 40°F RATED	4	EA	—	—	55	220.-	
(BARBER-COLMAN TA-115)							
(MOUNTED BY ELECTR.)							
PIPE C.S. SCH 80							
3/4" DIA	200	LF	.14	28	1.62	324.-	
ELBOW, M.I. 150# 90°							
3/4" DIA	20	EA	.57	11.4	.72	14.40	
TEE, M.I. 150#							
3/4"	10	EA	.89	8.9	1.14	11.40	
PLUG, M.I. 150#							
1/2"	5	EA	.50	2.5	1.00	5.00	
UNION M.I. 300#	5	EA	.62	3.1	4.38	21.90	
VALVE, PLUG							
150# SCREWED	10	EA	.40	4.0	10	100.00	
HANGERS & SUPPORTS	120	Lb		3.0	.65	78.00	
SUBTOTAL PAGE 1				76.9		2694.40	

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 7-8-82 | SHEET 2 OF 3

PROJECT: NW BOUNDARY TREATMENT FACILITY

LOCATION: ROCKY MTN. ARSENAL, DENVER, COLO.

ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE:
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.:

ESTIMATOR: TKO

CHECKED BY: JMC

HVAC SUMMARY

	QUANTITY		LABOR M.H.		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	$ PER UNIT	$ TOTAL	
SUBTOTAL PAGE 1				76.9		2694.70	
VENT CHIMNEY, 5" DIA.	100	L.F.	.25	25	2.50	250.00	
VENT CAP	4	EA	.25	1	10	40.00	
PROPANE TANK 1000 GAL COMPLETE WITH ALL VALVES & FITTINGS (EATON LPG TANK)	1	EA	16	16	1500	1500.-	
REGULATOR VALVE 3/4" DIA (EATON) W/ PIGTAIL	1	EA	1	1	40	40.-	
EXHAUST FAN ACCESS. 4 DIA	1	EA	1		[illegible]	[illegible].-	
[illegible] 20 FT 3" DIA GALV. STEEL	20	FT	[illegible]	[illegible]	.66	13.20	
WALL FLANGE 6"x6"	1	EA	1	1	5	5.-	
THERMOSTAT HONEYWELL-CHRONAIR TH-121	1	EA	1	1	40	40.-	
SUBTOTAL PAGE 2				123.5		4645.90	

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 7-13-82 | SHEET 3 OF 3

PROJECT: NW BOUNDARY TREATMENT FACILITY

LOCATION: ROCKY MTN. ARSENAL, DENVER, COLO.

ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE:
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: TRO

CHECKED BY: JMC

HVAC SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL MH	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
TOTAL FROM PG 2				123.5 MH		$4645.90	
.. COST OF LABOR	123.5	MH	$24.42	3015.87			
∴ TOTAL COST				3015.87		4645.90	7661.77
BREAK OUT							
FUEL - PIPING				32.9		428.70	
- PROPANE TK				17.0		1540.00	
COST OF LABOR	49.9	MH	$24.42	1218.56			
TOTAL COST - FUEL (SUPPORT UTILITIES)							3187.26

ENG FORM 150
1 AUG 59

PREVIOUS EDITION MAY BE USED

* U.S. GOVERNMENT PRINTING OFFICE 1980 O—316148

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 7-13-82 | SHEET 1 OF 5

PROJECT: NORTH WEST BOUNDARY CONTAINMENT/ TREATMENT SYSTEM

LOCATION: ROCKY MOUNTAIN ARSENAL

ARCHITECT ENGINEER:

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.:

ESTIMATOR: THORNLEY

CHECKED BY:

PLUMBING SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL M.H	MATERIAL $ PER UNIT	MATERIAL $ TOTAL	TOTAL COST
PIPE - ASTM B-88							
TYPE K							
3/4"	107.0	LF	.19	20.33	1.62	173.34	
1/2"	15.0	LF	.16	2.40	1.17	17.55	
FITTINGS							
WROUGHT COPPER,							
SOLDER JOINT							
ANSI B16.22							
TEE							
3/4"	1	EA	.67	.67	.52	.52	
90° ELL							
3/4"	8	EA	.42	3.36	.38	3.04	
1/2"	4	EA	.40	1.60	.14	.56	
COUPLING							
3/4"	4	EA	.38	1.52	.20	.80	
BUSHING							
3/4" x 1/2"	3	EA	.38	1.14	.20	.60	
SUB TOTAL PAGE 1				31.02		196.41	

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-13-82 | SHEET 2 OF 5

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO. | ESTIMATOR: THORNLEY | CHECKED BY

PLUMBING SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL MH	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUBTOTAL PAGE 1				31.02		196.41	
UNIONS -							
WROUGHT COPPER							
SOLDER JOINT							
1/2"	2	EA	.42	.84	1.47	2.94	
3/4"	2	EA	.44	.88	1.82	3.64	
VALVES - GLOBE							
125# BRONZE							
SOLDER JOINT							
1/2"	3	EA	.33	.99	11.50	34.50	
3/4"	2	EA	.40	.80	14.75	29.50	
SUBTOTAL PAGE 2				34.53		266.99	

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-13-82	SHEET 3 OF 5

PROJECT: NORTH WEST BOUNDARY CONTAINMENT / TREATMENT SYSTEM

LOCATION: ROCKY MOUNTAIN ARSENAL

ARCHITECT ENGINEER:

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.:

ESTIMATOR: THORNLEY

CHECKED BY:

PLUMBING SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL MH	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUBTOTAL PAGE 2				34.53		266.99	
PIPE - CAST IRON ASTM A-74 HUB. W/PLAIN END SPIGOT SERVICE WEIGHT							
4" X 6'-6"	3	EA	2.36	7.08	4.68	91.26	
4" X 6'-0"	2	EA	2.18	4.36	4.68	56.16	
4" X 5'-0"	3	EA	1.82	5.46	4.68	70.20	
4 X 10'-0"	2	EA	3.64	7.28	4.68	93.60	
FITTINGS CAST IRON ASTM A-74 SERVICE WEIGHT							
NIPPLES							
4" X 1'-0"	4	EA	.36	1.44	4.68	18.72	
4" X 1'-6"	4	EA	.55	2.2	4.68	28.08	
4" X 2'-0"	4	EA	.73	2.92	4.68	37.44	
4" x 2 7/8" (AS 1')	4	EA	.36	1.44	4.68	4.68	
SUB TOTAL PAGE 3				66.71		667.13	

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-13-82 | SHEET 4 OF 5

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR THORNLEY

CHECKED BY

PLUMBING SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL M.H	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUBTOTAL PAGG 3				66.71		667.13	
Y. BRANCH							
90° LONG TURN							
4"	2	EA	2.00	4.00	15.80	31.60	
P-TRAP							
4"	3	EA	1.23	3.69	12.45	37.35	
45° ELBOW							
4"	12	EA	1.23	14.76	6.75	81.00	
90° ELBOW							
4"	1	EA	1.23	1.23	8.50	8.50	
SUBTOTAL PAGE 4				90.39		825.58	

* U.S. GOVERNMENT PRINTING OFFICE 1958 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-13-84 | SHEET 5 OF 5

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR THORNLEY

CHECKED BY

PLUMBING SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL M.H	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUBTOTAL PAGE 4				90.39		825.58	
PIPE C.S. GALVANIZED ASTM A-120 4"	30	LF	.44	13.2	11.95	358.50	
FLOOR DRAIN JOSAM SERIES 3510 4"	10	EA	1.33	13.3	41.40	414.00	
FLOOR CLEANOUTS JOSAN SERIES 8184	1	EA	1.33	1.33	14.40	14.40	
SUBTOTAL PAGE 5				118.22		1612.48	
TOTAL COST OF LABOR	118.22	MH.	24.42	2886.93			
TOTAL COST OF MATERIAL						1612.48	
TOTAL COST							4,499.41

* U.S. GOVERNMENT PRINTING OFFICE 1958 O—516148

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-8-82	SHEET 1 OF 15

PROJECT: NORTH WEST BOUNDARY CONTAINMENT/ TREATMENT SYSTEM

LOCATION: ROCKY MOUNTAIN ARSENAL

ARCHITECT ENGINEER: STEARNS - ROGER 26616

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: FK

CHECKED BY: [illegible]

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H PER UNIT	LABOR M.H TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
MECHANICAL WORK							
PIPE PVC							
SCH 80							
1" DIA	10	LF	.24	2.4	.26	2.6	
1½" DIA	30	LF	.31	9.3	.44	13.20	
2" DIA	180	LF	.36	64.8	.60	108.00	
4" DIA	165	LF	.48	79.2	1.80	297.00	
6" DIA	226	LF	.57	128.82	3.44	777.44	
8" DIA	40	LF	.73	29.2	5.13	200.20	
10" DIA	20	LF	.83	16.60	7.75	155.00	
12" DIA	74	LF	.96	71.04	10.67	789.58	
				401.36		2352.02	

* U.S. GOVERNMENT PRINTING OFFICE 1958 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-8-82 | SHEET 2 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO. | ESTIMATOR FM | CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
PVC FITTINGS	SCH 80			401.36		2352.02	
90° ELL (SLIP)							
1 1/2" DIA	8	EA	.62	4.96	2.14	17.12	
2" DIA	30	EA	.73	21.90	2.92	87.60	
4" DIA	20	EA	1.33	26.60	15.63	312.60	
6" DIA	24	EA	2.29	54.96	35.65	855.60	
12" DIA	4	EA	4.8	19.20	214.48	857.92	
45° ELL (SLIP)							
2" DIA	10	EA	.73	7.3	2.92	29.20	
4" DIA	12	EA	1.33	15.96	13.28	159.36	
TEE (SLIP)							
2" DIA	10	EA	1.14	11.40	3.39	33.90	
4" DIA	12	EA	2	24.-	25.60	307.20	
6" DIA	9	EA	3.2	28.8	51.23	461.07	
10" DIA	1	EA	4.8	4.8	99.92	99.92	
				621.24		5573.51	

* U.S. GOVERNMENT PRINTING OFFICE 1959 O—516148

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-8-22	SHEET 3 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR EM

CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				691.24		5573.51	
12" DIA	1	EA	6.0	6.00	150.24	150,24	
COUPLINGS (SLIP							
2" DIA	20	EA	.73	14.60	2.38	47.60	
4" DIA	15	EA	1.33	19,95	9,86	147.90	
6" DIA	20	EA	2.30	46.00	15.37	307.40	
8" DIA	3	EA	3.0	9.0	37.73	226.38	
12" DIA	12	EA	4.0	48.0	29.44	353.28	
REDUCER BUSHING							
(SPIG x SLIP)							
10" x 8" DIA	3	EA	3.5	10.5	62.21	186.63	
12" x 8" DIA	1	EA	4.00	4.0	132.14	132.14	
12" x 10" DIA	1	EA	4.00	4.0	99.54	99.54	
6" x 4" DIA	6	EA	2.30	13.8	12.20	73.20	
				806.09		7297.82	

CONSTRUCTION COST ESTIMATE

DATE PREPARED

SHEET 4 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR FK

CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
REDUCING				806.09		7297.82	
COUPLING (SLIP)							
8" x 6" DIA	3	EA	3.0	9.0	21.28	63.84	
10" x 8" DIA	1	EA	3.2	3.2	24.24	24.24	
6" x 4" DIA	6	EA	2.3	13.80	12.20	73.20	
				832.09		7459.10	

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-7-82 | SHEET 5 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO. | ESTIMATOR FH | CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				832.09		7,459.10	
FLANGE IN PVC							
150# DRILLING							
SLIP TYPE SCH80							
2" DIA	10	EA	.40	4.0	4.80	48.00	
2½" DIA	1	EA	.46	.46	10.14	10.14	
4" DIA	60	EA	.66	39.6	16.04	962.40	
6" DIA	76	EA	.84	63.84	20.94	1591.44	
12" DIA	2	EA	1.5	3.00	66.78	133.56	
				942.99		10204.64	

CONSTRUCTION COST ESTIMATE	DATE PREPARED	SHEET 6 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR FRANK

CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL MH	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
OPW ADAPTOR-633F				942.99		10207.64	
MALE TYPE W/N.P.T.							
MATERIAL - ALUM.							
W/ VITON A - GASKET							
4"	2	EA	2.9	5.8	56.04	112.08	
2½"	1	EA	1.6	1.6	21.22	21.22	
OPW CAP - 634B							
FOR USE W/ADAPTORS							
MATERIAL - ALUM.							
W/VITON A - GASKET							
4"	2	EA	1.5	3.0	48.84	97.68	
2½"	1	EA	1.0	1.0	28.04	28.04	
				954.39		10463.66	

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-7-82	SHEET 7 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR FK

CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				957.39		10463.66	
BUTTERFLY VALVE,							
IN PVC, WAFER							
TYPE WITH METAL							
HANDLE 4" DIA	17	EA	2.82	47.94	101.70	1724.90	
(+GF+ #367)							
DITTO 6" DIA	6	EA	3.3	19.80	161.10	966.60	
BALL VALVE							
IN PVC, SINGLE							
UNION, VITON SEAL							
1" DIA	6	EA	.35	2.10	23.13	138.78	
(GF #345)							
DITTO 1½" DIA	6	EA	.40	2.40	37.94	227.64	
SWING CHECK							
VALVE IN PVC							
W/ DISC SEAT AND							
SPRING BALANCED							
DISC, FLANGED							
4" DIA	1	EA	3.25	3.25	550.-	550.00	
(PPS FIG 0841342)							
				1029.88		14075.58	

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-7-82 | SHEET 8 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO. | ESTIMATOR FK | CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				1029.88		14075.5K -	
DITTO 6" DIA	4	EA	4.95	19.80	1050 -	4200 00	
BALL VALVE IN PVC COMPACT W/ VITON SEAL 2" DIA (GF # 550)	3	EA	.47	1.41	30.60	91.20	
				1051.09		18367.38	

* U.S. GOVERNMENT PRINTING OFFICE 1959 O—516148

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-7-82	SHEET 9 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO. | ESTIMATOR FH | CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				1057.09		18367.38	
PRESSURE GAGE							
ASS'Y CONSISTING							
OF PVC INSTRUMENT							
TEE, 2 GLOBE							
VALVES 1/4"							
FITTINGS,							
GAGE GARD &							
PRESSURE GAGE							
FOR 2" DIA PIPE	2	EA	5.0	10	66.00	132.00	
DITTO FOR 6" PIPE	3	EA	5.2	15.6	70.00	210.00	
VALVES - FLOW RATE							
CONTROL							
IRON BODY, SS							
TRIM, INCL. PILOT							
& ORIFICE							
6" DIA							
FLANGED	3	EA	8	24	1776.00	328.-	
				1100.69		24037.38	

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-9-82 | SHEET 10 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☑ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO. | ESTIMATOR FK | CHECKED BY Thomas

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				1100.69		24 037.38	
PIPE, CARBON STEEL, SCH. 40, POLY-PROPYLEN LINED, FLANGED, SHOP PREFAB IN SPOOLS							
2" DIA (6' LONG PCS)	270	LF	.39	105.30	14.91	4025.70	
4" DIA (6' LONG PCS)	35	LF	.69	24.15	29.33	1026.55	
FITINGS, C.I. POLY PROPYLEN LINED FLANGED 150#							
TEE 2" DIA	4	EA	1.45	5.80	70.20	280.80	
90° ELL 2" DIA	12	EA	.89	10.68	51.30	615.60	
45° ELL 2" DIA	5	EA	.89	4.45	63.90	319.50	
				1251.07		30305.53	

* U.S. GOVERNMENT PRINTING OFFICE : 1959 O—516148

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-9-82	SHEET 11 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO. | ESTIMATOR FK | CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				1251.07		30305.53	
90° ELL 4" DIA	8	EA	2.67	21.36	89.10	712.80	
VALVES PLUG							
C.S BODY							
POLY PROPYLEN							
LINED FLANGED							
150# RATING							
2" DIA	8	EA	1.00	8.00	446.40	3571.20	
VALVES BALL							
C.S BODY							
POLY PROPYLEN							
LINED FLANGED							
150# RATING							
2" DIA	3	EA	1.00	3.00	872.00	2616.00	
				1283.43		37205.53	

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-9-82 | SHEET 12 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO. | ESTIMATOR FK | CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H. PER UNIT	LABOR M.H. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
				1283.43		37205.53	
PIPE, CARBON STEEL							
SCH 80, SOCKET							
WELDED							
(COMPRESSED AIR							
SYSTEM)							
2" DIA	60	LF	.26	15.60	4.40	264.00	
VALVES, GLOBE							
BRONZE, SCREWED							
ENDS, 150#							
SERVICE							
2" DIA	3	EA	.73	2.19	80.00	240.00	
VALVES, GATE							
BRONZE, SCREWED							
ENDS 150#							
2" DIA	2	EA	.73	1.46	42.00	84.00	
				1302.68		37793.53	

* U.S. GOVERNMENT PRINTING OFFICE : 1959 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED

SHEET 13 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR FM

CHECKED BY JMC

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR M.H PER UNIT	LABOR M.H TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
ADDITIONAL				1302.68		37.793.53	
HANGERS & SUPPORTS							
	1200	lb		10.00	.65	780	
BOLTING MATERIAL						1200	
FLOW MONITOR-POS. DISPL							
	3		—	—	1300.-	3900.-	
			M.H. 1312.68			$43673.53	
PIPING TOTAL:							
LABOR	M.H						
	1312.68		@	24.42	=	$	32055.65
MATERIAL						$	43673.53

* U.S. GOVERNMENT PRINTING OFFICE 1959 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED

SHEET 14 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR FH

CHECKED BY

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR MH. PER UNIT	LABOR MH. TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
EXCAVATION							
20FT LONG, 4FT DEEP, 9FT WIDE	23.7	CU YARD	1.6	37.92			
BACK FILL	23.7	CU YARD	.80	18.96			
TOTAL			15.41	56.88		$	876.52

ENG FORM 150
1 AUG 59

(ER 1110-345-730)

PREVIOUS EDITION MAY BE USED

(TRANSLUCENT)

* U.S. GOVERNMENT PRINTING OFFICE 1959 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED 7-12-82 | SHEET 15 OF 15

PROJECT

LOCATION

ARCHITECT ENGINEER

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO. | ESTIMATOR FK | CHECKED BY JMC

SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
SUMMARY :							
PIPING LABOR				32055.65			
MATERIAL						43673.53	
PLUMBING							
LABOR				2886.93			
MATERIAL						1612.48	
HVAC							
LABOR				3015.87			
MATERIAL						4645.90	
EXCAV & BACKFILL							
LABOR				876.52		—	
SUBTOTAL							
TOTAL				38834.97		49931.91	88766.88

* U.S. GOVERNMENT PRINTING OFFICE : 1959 O—516148

CONSTRUCTION COST ESTIMATE

DATE PREPARED: 7-13-82 | SHEET 1 OF 3

PROJECT: NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM

LOCATION: RMA - COMMERCE CITY, COLO

ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.:

ESTIMATOR: WEW

CHECKED BY: [illegible]

ELECTRICAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
LIGHTING FIXTURES	SHEET	2		1359		1325	
DISTRIBUTION	"	2		2712		10450	
DEVICES	"	2		230		706	
LIGHTNING PROTECTION	"	2		2885		1788	
GROUND GRID	"	3		2835.		1230	
WIRE & CONDUIT	"	3		7074		2277	
MOTOR & CONTROL	"	3		576		—	
TOTAL BARE COST =				$17,671		$17,776	$35,447

ENG FORM 150
1 AUG 59

(ER 1110-345-730) PREVIOUS EDITION MAY BE USED (TRANSLUCENT)

* U.S. GOVERNMENT PRINTING OFFICE : 1959 O—516148

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-9-82	SHEET 2 OF 3

PROJECT: NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM
LOCATION: RMA - COMMERCE CITY, COLO
ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.: | ESTIMATOR: W.E.W. | CHECKED BY: [illegible]

ELECTRICAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
LIGHTING FIXTURES			$		$		
150 W HPS	6	EA	180	1080	150	900	
COE TYPE WB-1 ENTRY FIXT.	1	EA	60	60	40	40	
EXIT SIGN W/ POWER PACK & 1 REMOTE HEAD	1	EA	53	53	250	250	
COE TYPE R-2D LAV. FIXT.	1	EA	53	53	15	15	
COE TYPE VG-4	1	EA	53	53	45	45	
RECESSED HEAT LAMP FOR LAVRATORY	1	EA	60	60	75	75	
				$1359		$1325	
DISTRIBUTION							
20 CKT LTG PNL.	1	EA	600	600	950	950	
10KVA DRY-TYPE TRANS	1	EA	312	312	500	500	
MCC, 3-VERT. SECT.	1	EA	1800	1800	9000	9000	
				$2,712		$10450	
DEVICES							
SWITCH-BOX-COVER	4	EA	12	48	40	160	
DUPLEX RECP-BOX-COVER	13	EA	14	182	42	546	
				$230		$706	
LIGHTNING PROT.							
CADWELDS & MISC.	50	EA			3	150	
CLASS I CONDUCTOR	400	FT		—	1	400	
CU AIR TERMINALS	12	EA		—	5	60	
POINT BASES	12	EA		—	17	204	
CABLE HOLDERS	130	EA		—	2	260	
GROUND RODS	6	EA		—	30	180	
ADHESIVE FOR AIR TERM. & HOLDERS	15	GAL		—	34	510	
CABLE SPLICERS	4	EA		—	6	24	
						$1788	
LABOR	JOB	120 HRS	24.04	2,885			

CONSTRUCTION COST ESTIMATE	DATE PREPARED 7-12-82	SHEET 3 OF 3

PROJECT: NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM
LOCATION: RMA – COMMERCE CITY, COLO
ARCHITECT ENGINEER: STEARNS-ROGER

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.: | ESTIMATOR: WEW | CHECKED BY: AGL

ELECTRICAL SUMMARY	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	LABOR PER UNIT	LABOR TOTAL	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
GROUND GRID			$		$		
#2/0 SDBC CROSS-RUN	200	LF	1.56	312	1.35	270	
#4/0 SDBC PERIM. RUN	300	LF	1.92	576	2.20	660	
BOLTED CONNS. ABOVE GRADE	JOB	60 HRS	24.04	1442	LS	100	
CADWELD CONNS. & MISC	JOB	21 HRS	24.04	505	LS	200	
				2835		$1230	
WIRE & CONDUIT							
3" RGS CONDUIT & FITTINGS	100	LF	12	1200	4.50	450	
1½" RGS " "	200	LF	5.75	1150	1.55	310	
1" RGS (TEL. CONDUIT)	60	LF	3.60	216	1.00	60	
3/4" RGS CONDUIT & FITTINGS	1000	LF	3.35	3350	0.80	800	
1" RGS CONDUIT & FITT.	50	LF	3.60	180	1.00	50	
1½" LIQUIDTIGHT FLEX	24	LF	7.90	190	5.00	120	
3/4" " "	12	LF	3.60	43	1.90	23	
WIRE, THHN-THWN:							
#6 AWG	800	LF	0.30	240	0.28	224	
#10 AWG	1000	LF	0.22	220	0.12	120	
#12 AWG	1500	LF	0.19	285	0.08	120	
				$7074		$2277	✓
MOTOR & CONTROL							
MOTOR HOOKUP	JOB	12 HRS	24.04	288		MATERIAL	
CONTROL CKT HOOKUP	JOB	12 HRS	24.04	288		ABOVE	
				$576			✓

ARMCO

ARMCO BUILDING SYSTEMS

J. SHELBY WELCH, JR.
District Manager

July 7, 1982

Stearns Roger Engineering Corporation
P. O. Box 5888
Denver, Colorado 80217

Attention: Mr. Steve Van Winkle

Reference: Northwest Boundary Ground Water Control System
Rocky Mountain Arsenal
Project No. C26616

Gentlemen:

In accordance with your request, we are pleased to submit for your consideration the following estimate for the above referred to project:

One complete Armco building, type RF-80, size 40'-0" wide x 72'-8" long x 30' high, designed for 30# LL and 25# WL per UBC. The roof panels to be 24 gage ALUMINIZED steel with standing seams and concealed fasteners. The wall panels to be 24 gage galvanized steel with interlocking ribs, concealed fasteners and factory finish color coating with a 20 year warranty. Both endwalls to be designed for future expansion. The following accessories are included:

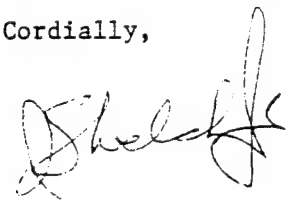
- 3 - 3070 single swing steel doors with top half glazed and necessary hardware
- 1 - 10' x 14' overhead sectional steel door insulated
- 1 - 12' x 24' overhead sectional steel door insulated
- 1 - 30' length of 12" throat ridge vent with damper and birdscreen
- Gutters and downspouts for both side walls
- Roof insulated with 3" fiberglass blanket to meet U factor of 0.10
- Walls insulated with 3" fiberglass batts to meet U factor of 0.15
- Steeliner to protect insulation up to 8' high around perimeter of building

All of the above delivered and erected on foundation by others for the sum of $63,000.00

At the present time and subject to prior orders received, shipment can be made in approximately six weeks.

We thank you for the opportunity to present this information. Please contact me if you have further questions.

Cordially,



JSW:mp

Enclosures

REFER TO Steve Van Winkle

NOTE

JUL 09 1982

Gen. Files

ANS'D

ARMCO

ARMCO BUILDING SYSTEMS

J. SHELBY WELCH, JR.
District Manager

July 8, 1982

Stearns Roger Engineering Corporation
P. O. Box 5888
Denver, Colorado 80217

Attention: Mr. Steve Van Winkle

Reference: Northwest Boundary Ground Water Control System
Rocky Mountain Arsenal
Project No. C26616

Gentlemen:

Supplementing our letter of July 7, please be advised that to increase the length of building to 77'-8" (3 bays @ 25') the cost would be increased by $1300.00.

Cordially,

JSW:mp

QUOTATION

GOULDS PUMPS, INC.

VERTICAL SUMP PUMP

REPLY TO:

PIONEER EQUIPMENT, INC.
P.O. Box 27024
Tucson, AZ 85726

Attn: Dick Cahill

All quotations subject to terms and conditions on the reverse side and expire unless accepted within 30 days from date of quotation. All quotations subject to change with or witnout notice.

FORM A8444 11 Sep 80001H

To: Rubel and Hager, Inc.
4400 E. Broadway
Tucson, AZ 85711

Date: 7/8/82 Page:
Proposal No.:
Revision No.:

Attention: Mr. Frederick Rubel, Jr., P.E.
Inquiry Date: 7/8/82
Inquiry No.: Rocky Mr. Arsenal Item No.: P-101, 102, 103, 104.

Copies: Goulds | Denver
Pioneer Equip, | Phoenix

In answer to your inquiry, we propose to furnish GOULDS PUMPS as described below:

CONDITIONS OF SERVICE —

LIQUID Water
G.P.M. 500 Sp. Gr. @ 60°F 1.0 PH Value Solids %
T.D.H 162 Sp. Gr. @ P.T. Abrasives Solids Size
Pumping Temp. Visc. @ P.T.

PUMP DESCRIPTION —

QUANTITY 4
MODEL 3171
Size 3X4-13
Group M
Pit Type ☒ Wet ☐ Dry
Pit Depth 12 fto.
Assembly No 22

MATERIALS:
Steady Bearing Lubrication
Support Plate Std.
Pit Cover None
Case Cast iron
Impeller Cast iron
Shaft Steel
Steady Brngs. Carbon

CONTROL EQUIPMENT:

Float Switch = 2
Alternator = None
Hi Water Alarm = None
Single Cont. Volts None
Mag Start Size None
NEMA Encl. 4

Efficiency 71.5
B.H.P. @ Rating 28.8
Max. B.H.P. 32.3

IMPELLER DIAMETER:

Approx. @ Rating 12.5
Min. Max. 10 / 13

For detailed specifications see Bulletin 726.1
Curve No. 1182-3

DRIVER —

H.P. 40 R.P.M. 1750 Phase/Hz 3/60 Volts 230/460
Enclosure 1.15/SF Insulation B Frame 324 Furnished by Goulds

UNIT PRICES —

PRICES ARE F.O.B LUBBOCK, TEXAS
Pre-paid job site

	$	Weight, pounds
PUMP SUPPORT PLATE and COUPLING		
COMPLETE PRICE EACH AS DETAILED ABOVE	5,332.00	1926
DRIVER		
FREIGHT (estimated)		
TOTAL ~~XXXXXX~~ QUANTITY FOUR	21,328.00	TOTAL WEIGHT 7704

SHIPMENT 6-8 weeks after complete engineering and manufacturing information and full approval to proceed with work

TERMS: 30 DAYS NET
PER APPROVED CREDIT

PIONEER EQUIPMENT, INC.

Dick Cahill
Richard J. Cahill
Sales Representative

S-101 A,B
S-102 A,B
S-103 A,B

FILTEMP SALES, INC.
filtration • flow • heat • control
243-4245

MAILING ADDRESS:
P.O. BOX 15173
PHOENIX, ARIZONA 85060

OFFICE:
3601 S. 42ND STREET
PHOENIX, ARIZONA 85040

July 8, 1982

RECEIVED
JUL 12 1982
RUBEL & HAGER, INC.

Rubel & Hager
4400 E. Broadway, Suite 602
Tucson, Arizona 85711

Attention: Mr. Fred Rubel

Reference: Rocky Mountain Arsenal
Northwest Boundary Treatment System

Dear Mr. Rubel:

We are pleased to quote the following Filterite Equipment per your request.

A Qty

6 Filterite Model 66MSO3-316-4FD-C150
Code Vessel - 316SS - 150 # Operating Pressure
1" NPT Vent - 1 1/2 " NPT Drain - 316SS
Top Seat Plate & Springs - Ethylene Propylene
Gasket - "UM" stamp standard - includes eye nuts -
Houses 22-30" cartridges - See Bulletin 1762.

Price each: $4,550.00
Qty--6 at:$ 27,300.00
Est Frt - Total: $580.00
6 Sets of Cart (U100AW30U) : $800.00

Total Cost: $28,680.00

B

Option B same as item A except Vessel is 304SS instead of 316SS.

Price each: $3,761.00
Qty--6 at: $22,566.00
Est Frt - Total: $580.00
6 Sets of Cart (U100AU30U) : $800.00

Total Cost: $23,946.00

C

Replacement Cartridges

Filterite U100AW30U
100 Micron - 30" length - Polypropylene
Core and Polypropylene Wind

Lot Price, 150 Cart : $975.00
F.O.B. Phoenix

Both Item A and Item B include non code stamp at no addtional charge. If you require "U" stamp then please add $250.00 to total cost. In my opinion the "UM" stamp is more than sufficient. Please contact our office if we can provide further information.

Sincerely,

George R. Metro
Filtemp Sales, Inc.

nam

ADSORPTION SYSTEM EQUIPMENT

Westvaco

July 9, 1982

Mr. Fred Rubel
Rubel & Hager, Inc.
4400 E. Broadway, Suite 602
Tucson, AZ 85711

Dear Fred:

In accordance with your request, I have enclosed a proposal for a Westvaco Pulsed Bed Adsorption System for the Northwest Boundary Containment Treatment Facility, Rocky Mountain Arsenal. Included is a budget estimate of the uninstalled cost of this equipment.

If you require further information or details, please contact me.

Sincerely yours,

Michael L. Massey, Ph.D., P.E.
Manager, Carbon Systems

MLM/sa
Enclosure

Chemical Division
Carbon Department
Covington, Virginia 24426
Telephone: 703-962-1121

PROPOSAL FOR A

WESTVACO PULSED BED ADSORPTION SYSTEM

PROVIDED BY

WESTVACO CORPORATION
CARBON DEPARTMENT
CARBON SYSTEMS GROUP
COVINGTON, VIRGINIA 24426

FOR

ROCKY MOUNTAIN ARSENAL

NW BOUNDARY TREATMENT SYSTEM

COMMERCE CITY, COLORADO

JULY 9, 1982

Introduction

Westvaco has been requested to prepare a proposal, including budget estimate, for a Westvaco Pulsed Bed Adsorption System. This system will provide carbon adsorption treatment of groundwater at the proposed NW Boundary project at Rocky Mountain Arsenal, Commerce City, CO.

The treatment process will consist of the following:

A. Three standard pulsed bed adsorption columns.

B. Two carbon storage tanks, one for fresh carbon and one for spent carbon.

C. A dual blowcase assembly for carbon transport.

D. 150,000 pounds of virgin carbon, Nuchar WV-G.

The price covers the cost of delivery of assembled treatment modules as described in the process description. It does not cover the cost of on-site installation. Details of the proposed system are as follows:

Process Description

The Westvaco Pulsed Bed Adsorption System shall include the following standard Westvaco components as required by the specifications:

A. Adsorption Unit

1. The carbon adsorption system shall be three upflow Pulsed Bed Systems as manufactured by Westvaco.

2. Each 42,000 lb contactor unit shall be a ten-foot diameter 1400 cu ft capacity ASME 50 psig Design Pressure Vessel with potable water lining.

3. Influent and effluent connections shall be designed to insure even flow distribution.

4. Each adsorber shall be mounted on a support structure designed to support the contactor and all piping and attached equipment under all operating conditions. The support structure shall be designed to provide ready access to piping and valves.

5. Connections to each adsorber shall be as follows:

   a. Raw water inlet and treated water outlets shall be four 6-inch connections.

   b. Fresh carbon inlet and spent carbon outlet connections shall be 2-inch and properly designed to facilitate carbon handling.

   c. Three 1/2-inch 316SS sample nozzles are to be spaced at the quarter points of the adsorber, with the nozzle penetrating 6 inches into the carbon bed.

6. Each adsorber shall be furnished with two 20-inch diameter manholes--one manhole to be located on the top of the vessel and the other on the side near the bottom of the vessel. An access ladder in conformance with applicable safety standards shall be provided for the top manhole.

B. Fresh Carbon Storage Tank

1. One ten-foot diameter 740 cu ft capacity fresh carbon storage tank shall be provided. The tank will be an open top cone-bottom vessel suitable for storing a minimum of 20,000 lb (dry weight) of spent carbon. A full water level will be maintained in the tank by a float valve.

2. The tank shall be of all-welded carbon steel construction with potable water lining.

3. The structure and baseplate shall be designed to support the tank, tank contents, and attached equipment under all operating conditions. Lugs, adequate for all lifting and moving the tank, shall be provided.

4. Connections to the fresh carbon storage tank shall be as follows:

   a. The bottom carbon outlet shall be 4-inch diameter (minimum)

   b. A 2-inch diameter raw water connection

   c. The tank overflow shall be 4-inch diameter and shall be located above the normal liquid level. The outlet shall be screened to prevent loss of activated carbon.

C. Spent Carbon Storage Tank

1. One ten-foot diameter 740 cu ft capacity spent carbon storage tank shall be provided. The tank will be an open top cone bottom vessel suitable for storing a minimum of 20,000 lb (dry weight) of spent carbon. A full water level will be maintained in the tank by a float valve. Removal of spent carbon will be by the use of an eductor.

2. The tank shall be all-welded carbon steel construction with potable water lining.

3. The structure and baseplate shall be designed to support the tank, tank contents, and attached equipment under all operating conditions. Lugs, adequate for all lifting and moving of the tank, shall be provided.

4. Connections to the spent carbon storage tank shall be as follows:

   a. The bottom carbon outlet shall be 4-inch diameter (minimum)

   b. A 4-inch diameter raw water connection

   c. The tank overflow shall be 4-inch diameter and shall be located above the normal liquid level. The outlet shall be screened to prevent loss of activated carbon.

D. Carbon Transport System

1. The carbon transport system shall consist of separate fresh and spent carbon blowcases to transfer carbon slurry from the fresh carbon storage tank to each adsorber unit and from each adsorber unit to the spent carbon storage tank. Carbon transport will be by air pressurization and eductors. Normal pulsing operation will consist of transporting 2,000 lb of dry carbon per cycle.

2. The blowcases shall be 70 cu ft capacity ASME 50 psig Design Pressure Vessels. All wetted parts of the vessels shall be 316 L stainless steel. The pressure vessels shall be stamped in compliance with ASME Code.

3. A common support structure and baseplate shall be provided for the two blowcases. The support structure and baseplate shall be designed to support the blowcases, contents, and all attached piping and appurtenances under all operating conditions. The support structure shall be carbon steel. Lifting lugs, adequate for all lifting and moving of the blowcases, shall be provided.

4. Each blowcase shall be provided with a 16-inch diameter quick-opening, hinged manhole for top access and observation. An access ladder and platform, designed in conformance with applicable safety standards, shall be provided.

E. Granular Activated Carbon

Westvaco shall supply and install an initial inventory of 150,000 lb of virgin granular activated carbon. The initial carbon supply shall be Westvaco Nuchar WV-G.

Price

The estimated cost for the equipment as described in this proposal is $638,000, FOB job site.

QUOTATION

J & B SALES CO.

3441 N. 29th AVE. • PHOENIX, ARIZONA 850
TELEPHONE 602 • 253-1545

JOB Rocky Mountain Arsenal — Page 1 of 1

N.N. Boundry Treatment System — Arch. Rubel & Hager

P-105 — Engr. Rubel & Hager

Quote No. 2106 — Date 7-8-82 — Due 7-9-82

Quan.	Description	Net Price

To: Rubel & Hager, Inc
4400 E. Broadway, Suite 602
Tucson, AZ 85711

Attn: Mr. Fred Rubel

1 Bell & Gossett Model 1531 - 2AC Close Coupled Pump.
Duty: 175 gpm @ 175 TDH 5,200' Elev.
15 HP 460/3/60 3500 rpm ODP Motor

Total Price FOB Factory, 7FA Commerce City, Colorado. . $1,600.00

RECEIVED
JUL 9 1982
RUBEL & HAGER, INC.

Above Prices Are Full Freight Allowed, Unless Otherwise Stated.
Starters, Vibration Bases & Accessories Are Not Included Unless Listed.
Quotation Automatically Expires Thirty (30) Calendar Days From The Date Issued.

QUOTATION

ALBANY INTERNATIONAL
Engineered Systems Division

P.O. BOX 310, QUAKER RD., GLENS FALLS, N.Y. 12801 / TEL. 518-793-8801 / TELEX 145339

Mr. Fred Rubel
RUBEL & HAGER
4400 East Broadway
Suite 602
Tucson, AZ 85711

July 8, 1982

Quotation Number: Q82-041T

S-104

QTY.		UNIT PRICE	TOTAL
1	AES Model 5250S20A2 Multiple Filter with external backwash		70,133.00
	Application: Granular Activated Carbon Pressure Rating: 25 psi (operating pressure) Flow: 1500 gpm Fabrication: 316 stainless steel Construction: 20 barrels; assembled and mounted on a mild steel frame. Inlet/Outlet Header Size: 12" flanged External Backwash Header: 2" threaded Drain Size: 2-1/2" threaded Media: .003" wedge wire Valve Size & Seats: 2" Teflon Seals: EPDM Gauges: 0-400 psi Filter Media Area: 8160 sq. inches Backwash Automation (Time Clock and Differential Pressure Switch)		
	Option:		
	Service Step		500.00
	Reference Drawing: D-10640		

WARRANTY: ALBANY ENGINEERED SYSTEMS WARRANTS ALL AES PRODUCTS AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP IN NORMAL USE FOR ONE YEAR FROM DATE OF SHIPMENT, SUCH WARRANTY BEING LIMITED TO REPLACEMENT OR REPAIR OF DEFECTIVE PARTS AT OUR DISCRETION. WE HAVE NO LIABILITY FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED. THERE ARE NO OTHER WARRANTIES EXCEPT AS SET FORTH ABOVE.

CUSTOMER'S COPY

QUOTATION

ALBANY INTERNATIONAL
Engineered Systems Division

P.O. BOX 310, QUAKER RD., GLENS FALLS, N.Y. 12801/TEL. 518-793-8801/TELEX 145339

 Quotation Number: Q82-041T

MANUALS : Two operating manuals supplied with purchase of this equipment. Additional manuals $15 each. Reproducibles of drawings (sepias or microfile aperture cards) available at $5 each.

START-UP SERVICE : For the AES Products as outlined in this quotation, no charge service will be provided as follows:

Field Service Technician: Two Days
Applications Engineer : Two Days

The customer has the option of assigning this no charge service time for Training Sessions, Installation Inspection or Start-Up Assistance. Should additional service be required, the following rates apply:

Field Service Technician @ $220 per day
Applications Engineer @ $350 per day

When service is scheduled by the customer with less than one week's notice, travel expenses will be charged at cost. A Purchase Order must be issued to cover the additional service requirements beyond the allocation as stated above.

VALIDITY: The prices quoted are firm for order placement 60 days from the date of this quotation for delivery not to exceed six (6) months from date of order issuance.

QUOTATION

ALBANY INTERNATIONAL
Engineered Systems Division

P.O. BOX 310, QUAKER RD., GLENS FALLS, N.Y. 12801/TEL. 518-793-8801/TELEX 145339

 Quotation Number: Q82-041T

SHIPMENT: After receipt of order and full customer approved technical data enabling us to proceed with engineering and manufacturing, our delivery schedule for the equipment specified in this quotation is detailed below. Any delay in our receipt of customer approved technical data may adversely affect the delivery date.

FOB: Denver, Co - 12-14 weeks

TERMS : 25% with prints for customer approval - Net 30 days.
75% at shipment - Net 30 days.

ACCEPTANCE: Orders are subject to acceptance at Glens Falls, NY.

By: Peg Campbell

Customer Service

WARRANTY: ALBANY ENGINEERED SYSTEMS WARRANTS ALL AES PRODUCTS AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP IN NORMAL USE FOR ONE YEAR FROM DATE OF SHIPMENT, SUCH WARRANTY BEING LIMITED TO REPLACEMENT OR REPAIR OF DEFECTIVE PARTS AT OUR DISCRETION. WE HAVE NO LIABILITY FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED. THERE ARE NO OTHER WARRANTIES EXCEPT AS SET FORTH ABOVE.

CUSTOMER'S COPY

PROPOSAL

☐ P.O. Box 6753
Phoenix, Arizona 85005-6573
(602) 269-1323

PIONEER EQUIPMENT INC

☒ P.O. Box 27024
Tucson, Arizona 85726-7024
(602 792-3255

FORMERLY AIR COMPRESSOR SERVICE

TO: Rubel and Hager, Inc.

DATE July 8, 1982
This proposal effective for 30 Days.

Attn: Mr. Frederick Rubel, Jr., P.E.

Gentlemen: We are pleased to quote on the following equipment: C-101

QUAN.	DESCRIPTION	UNIT PRICE	AMOUNT
ONE	INGERSOLL-RAND COMPRESSOR PACKAGE, MODEL 7E3, COMPLETE WITH THE FOLLOWING MAJOR COMPONENTS: a) BARE COMPRESSOR #253 b) 7½ H.P. NEMA 3 PHASE 230/460 V MOTOR c) 120 GAL. ASME RECEIVER TANK d) PRE-WIRED AND MOUNTED MAGNETIC STARTER e) AIR COOLED INTERCOOLER f) ENCLOSED BELT GUARD g) AUTO/START/STOP CONTROL h) SAFETY SERVICE AND DRAIN VALVE. PERFORMANCE DATA a) 26.2 CFM PISTON DISPLACEMENT b) 20.3 CFM @ 100 PSI c) COMPRESSOR RPM - 660.		
	TOTAL NET PRICE.....		2,800.00
	All Applicable Taxes to Apply		

F.O.B. Delivered Job Site

Delivery One week

Terms Net 30 days

PIONEER EQUIPMENT, INC.

BY Dick Cahill

This quotation not valid unless signed

Prices quoted are subject to adjustment to price in effect at time of shipment.

Warranty is limited to that on new machines as furnished by Manufacturers or as otherwise stated herein.

All items quoted herein are subject to prior sale or other disposition.

All orders taken which require financing are subject to the approval of our credit department or that of the financing institution.

Delivery date given on this order is contingent upon promised shipment from our suppliers and upon government restrictions or other factors beyond our control.

The above proposal is hereby accepted as outlined:

Customer _____

BY _____

Northwest Boundary Containment Treatment Facility

Rocky Mountain Arsenal, Commerce City, Colorado

Stearns-Roger Subcontract No. 7000 C26616

Process Design Calculations

Prepared by: D. G. Hager
Checked by: F. Rubel, Jr.

I. Sizing of Liquid Phase Adsorption Vessels

A. Design Criteria

1) Superficial residence (empty bed) time required in upflow packed granular activated carbon bed for removal of 0.8 µg/l excess DBCP from potable water - 15 minutes minimum.

2) Raw water flow rate - 1500 gpm maximum.

3) Standard Westvaco Pulse Bed Adsorber volume - 1400 ft.^{3}.

B. Calculations

1)a. Try two (2) standard Pulse Bed Adsorbers -

Volume = 2 x 1400 ft^3 = 2800 ft^3 = 21,000 gallons

$$\text{Superficial Residence Time} = \frac{21{,}000 \text{ gallons}}{1500 \text{ gpm}} =$$

14 minutes <15 minutes.∴ NG

b. Try three (3) standard Pulse Bed Adsorbers -

Volume = 3 x 1400 ft^3 = 4200 ft^3 = 31,500 gallons

$$\text{Superficial Residence Time} = \frac{31{,}500 \text{ gallons}}{1500 \text{ gpm}} =$$

21 minutes >15 minutes.∴ OK

Use Three (3) standard Pulse Bed Adsorbers

2) Flow rate per adsorber

$\frac{1500 \text{ gpm}}{3 \text{ adsorbers}}$ = 500 gpm/adsorber

II. Process Pipe Sizing

A. Design Criteria

1) Pipe material - schedule 80 Type I PVC
2) Flow rate per treatment branch (train)=<500 gpm
3) Raw water velocity ≤8.0 ft/sec
4) Treated water velocity ≤5.0 ft/sec
5) Slurry Flush/Eductor/Backwash water velocity ≤8.0 ft/sec

B. Calculations

1) Raw water pipe size (identical piping for each train)

a) Try 4", v = 8.99 ft/sec >8.0 ft/sec ∴ NG
b) Try 6", v = 6.27 ft/sec <8.0 ft/sec ∴ OK

Use 6" Schedule 80 Type I PVC Pipe and Fittings for Raw Water.

2) Treated water pipe size - Effluent from one adsorber

a) Try 6", v = 6.27 ft/sec >5.0 ft/sec ∴ NG
b) Try 8", v = 3.57 ft/sec <5.0 ft/sec ∴ OK

Use 8" Schedule 80 Type I PVC Pipe and Fittings for Effluent from one Adsorber.

3) Treated water pipe size - Effluent from two adsorbers

a) Try 8", v = 7.14 ft/sec >5.0 ft/sec ∴ NG
b) Try 10", v = 4.54 ft/sec <5.0 ft/sec ∴ OK

Use 10" Schedule 80 Type I PVC Pipe and Fittings for Effluent from two Adsorbers.

4) Treated water pipe size - Effluent from three adsorbers

a) Try 10", v = 6.80 ft/sec >5.0 ft/sec ∴ NG
b) Try 12", v = 4.81 ft/sec <5.0 ft/sec ∴ OK

Use 12" Schedule 80 Type I PVC Pipe and Fittings for Effluent from three Adsorbers.

5) Slurry Flush/Eductor/Backwash water pipe size

a) Try 3", v = 8.72 ft/sec >8.0 ft/sec ∴ NG
b) Try 4", v = 5.02 ft/sec <5.0 ft/sec ∴ OK

Use 4" Schedule 80 Type I PVC Pipe and Fittings for Slurry Flush/Eductor/Backwash Water System.

III. Carbon Slurry Transfer Pipe Sizing

A. Criteria

1. Carbon Slurry Transfer to and from Carbon Transport Trailer - 4" Polypropylene lined Carbon Steel (flanged) Pipe

2. Carbon Slurry Tansfer to and from Carbon Blowcases - 2" Polypropylene lined Carbon Steel (flanged) Pipe

3. Carbon Slurry Velocity = 5 ft/sec

4. Dry carbon density = 30 lb/ft^3

B. Calculations

1. Time to transfer 20,000 lbs. granular activated carbon truckload to or from Carbon Transport Trailer

Pipe inside diameter = 3.612 in., Area = 10.25 $in.^2$ = .0712 ft^2
@ velocity = 5 ft/sec Volume = 0.3558 ft^3/sec = 21.35 ft^3/min = 640 lb/min
Transfer Time = $\frac{20{,}000 \text{ lbs.}}{640 \text{ lbs/min}}$ = 31.3 minutes

2. Time to transfer 2,000 lb. granular activated Carbon Pulse to and from Carbon Blowcases

Pipe inside diameter = 1.723 in., Area = 2.35 $in.^2$ = .0164 ft^2
@ velocity = 5 ft/sec Volume = 0.0818 ft^3/sec = 4.91 ft^3/min = 147 lbs/min
Transfer Time = $\frac{2{,}000 \text{ lbs.}}{147 \text{ lbs/min}}$ = 13.6 minutes

IV. Process Water Pressure Drop through each Treatment Train

A. Criteria

1. Since the piping design has not been accomplished at this time, a pressure drop calculation based upon conservative assumptions is provided.

2. Flow rate 500 gpm through 6" and 8" Pipe; head loss per 100' is 0.87 and 0.22 psig respectively.

3. Flow rate 1500 gpm through 12" Pipe; head loss per 100' = 0.24 psig.

B. Calculations

1. Pressure Drop through Pipe and Fittings

	Equivalent Pipe Length	ΔP
a) 80'-6" Sch. 80 PVC Pipe	80	
b) 3 -6" Sch.80 PVC Tee @ 32.2'	96.6	2.3
c) 6 -6" Sch.80 PVC 90° Ell @15.2'	91.2	
d) 40'-8" Sch.80 PVC Pipe	40	
e) 1 -8" Sch.80 PVC Tee @39.9	39.9	0.4
f) 4 -8" Sch.80 PVC 90° Ell @20'	80	
g) 40'-12" Sch.80 PVC Pipe	40	0.3
h) 3 -12" Sch.80 PVC 80° Ell @ 30	90	
		3.0 psig

2. Pressure Drop Through Valves and Flow Controller

a) 1-6" Check Valve @ 0.1 psig@	0.1
b) 3-6: Butterfly Valves @ 0.3 psig@	0.9
c) 1- Rate of Flow Controller @ 7.0 psig (max.)	9.0
	10.0 psig

3. Pressure Drop Through Adsorber and Filter Modules (pressure drop will build up in each of these modules until a maximum is reached at which time backwash or cartridge change will significantly decrease the pressure drop).

	ΔP	
a) Prefilter Module - 15 psi (max.)	15.0	
b) Pulse Bed Adsorber Module - 25 psi (max.)	25.0	
c) Post filter Module - 10 psi (max.)	10.0	
	50.0	psig
4. Gravity head - 12 ft.	5.2	psig
5. Velocity head	0.3	psig
6. Total ΔP (1 through 5 above)	68.5	psig

FORM 62-114
REV. 4-75

Stearns-Roger

JOB NO 26616 DATE 7-2-82 BY GKW CH'K

CUSTOMER R M A. PROJECT GROUND WATER TREATMENT.

SUBJECT DESIGN LOADS STRUCTURAL.

PRELIMINARY DESIGN.

BUILDING LOADS

Roof
- DEAD LOAD = 20 PSF
- LIVE LOAD OR SNOW LOAD = 30 PSF = (0.8 × 35 PSF) ANSI 7.2.1
- CONTINGENCY LOAD AT MID SPAN = SAY 5.0 K.
- WALL LOAD = 5 PSF
- WIND LOAD = 24 PSF. ANSI EXPOSURE "C" 80 MPH.

SEISMIC ZONE 1

SOIL BEARING PRESSURE 3000 PSF.

EQUIPMENT LOADS

ADSORBERS	= 140,000 LBS.	EACH
DUAL BLOWCASE	= 20000 LBS	
STORAGE MODULE	= 75,000 LBS	EACH.
PREFILTERS	=	
POST FILTER	=	
PUMPS	=	

ACCESS WALKWAY DEAD LOAD = 25 PSF
LIVE LOAD = 100 PSF

ALLOW FOR EQUIPMENT PADS TO BE 4" ABOVE FINISHED FLOOR LEVEL WITH ALLOWANCE OF GROUT FOR LEVELLING.

FOUNDATION DEPTHS TO BELOW FROST LINE OF 3'-6".

AEIM 9. 1/81.

FORM 62.114
REV. 4-75

Stearns-Roger

JOB NO. 26616 DATE 7-2-82 BY GW CH'K

CUSTOMER R.M.A. PROJECT GROUND WATER TREATMENT

SUBJECT FOUNDATION LOADS FROM BUILDING

CENTER COLS.
TRIBUTARY WIDTH 25'-0" SPAN 40'-0"
HEIGHT 30'-0"

Roof DL = 20 × 25'-0" = 0.5 K/ft
LL = 30 × 25'-0" = 0.75 K/ft.
1.25 K/ft

REACTION AT COL = 1.25 × 40/2 = 25.0 K
5.0 K CONTINGENCY + 2.5 K
ROOF TOTAL/COL = 27.5 K

LOAD FROM SIDING = 5 × 25 × 30'0 = 3.75 K.

TOTAL VERTICAL AT BASE = 31.25 K

END COLS WILL BE 1/2 THIS LOAD
PLUS VERTICAL END WALL LOAD

= 31.25/2 + 5 × 14 × 30 = 17.73 K

WIND LOAD ON SIDE WALL
= 24 × 25'-0" = 0.6 K/ft CENTER COL
0.3 K/ft END COL

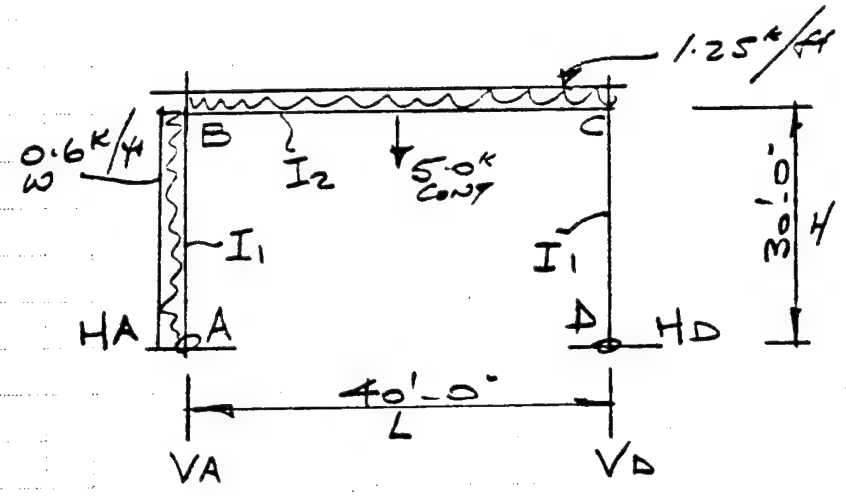
BY INSPECTION WIND WILL CONTROL BUILDING DESIGN AND SEISMIC WILL CONTROL FOUNDATIONS FOR INTERIOR VESSELS.

JOB NO. 26616 DATE 7-2-82 BY GEW CH'K

CUSTOMER RMA PROJECT GROUND WATER TREATMENT

SUBJECT FOUNDATION LOADS FROM BUILDING

FROM STEEL DESIGNERS MANUAL BY UNGER
USE FRAME TYPE II (Pg 291).



Assume I_1 & I_2 = 1.0

$$K = \frac{I_2}{I_1} \times \frac{30}{40} = 0.75$$

$$N = 2K + 3 = 4.75$$

Roof DL+LL

$$M_B = M_C = \frac{1.25 \times 40^2}{4 \times 4.75} = -105.26 \text{ K-ft}$$

$$V_A = V_D = \frac{wl}{2} = +25.0^K$$

$$H_A = H_D = -\frac{105.26}{30} = -3.5^K$$

WIND

$$M_B = \frac{0.6 \times 30^2}{4}\left[-\frac{0.75}{2 \times 4.75}(0.92) + 1\right] = +124.2 \text{ K-ft}$$

$$M_C = \frac{0.6 \times 30^2}{4}\left[\frac{-0.75}{2 \times 4.75}(1.08) - 1\right] = -145.8 \text{ K-ft}$$

$$H_D = -\frac{M_C}{H} = -\frac{145.8}{30} = -4.86^K$$

$$H_A = -(0.6 \times 30 - 4.86) = +13.14^K$$

$$V_A = -V_D = -\frac{0.6 \times 30^2}{2L} = V_A = -6.75^K \; V_D = +6.75^K$$

FORM 62-114
REV 4-75

Stearns-Roger

JOE NO 26616 DATE 7-2-82 BY GW CH'K
CUSTOMER RMA PROJECT GROUND WATER TREATMENT
SUBJECT FOUNDATION LOADS FROM BUILDING.

5.0^K CONTINGENCY LOAD.

$$M_B = M_C = -\frac{3 \times 5 \times 40}{8 \times 4.75} = -15.8^{K}ft$$

$$V_A = V_D = 5/2 = +2.5^{K}$$

$$H_A = H_D = -\frac{15.8}{30} = -0.53^{K}$$

TOTAL LOADS

LOAD	M_B	M_C	V_A	V_D	H_A	H_D
DL+LL	-105.26	-105.26	+25.0	+25.0	-3.5	-3.5
WIND	+124.2	-148.8	- 6.75	+ 6.75	-4.86	+13.14
5.0K.	-15.8	-15.8	+ 2.5	+ 2.5	- 0.53	- 0.53
DL+LL+5.0	-121.06	-121.06	+27.5	+27.5	-4.03	-4.03
WITH WIND AT 0.75	2.36^{Kft}	200^{Kft}	+15.56^{K}	+25.69^{K}	-6.67^{K}	+6.83^{K}

FORM 62-114
REV 4-75

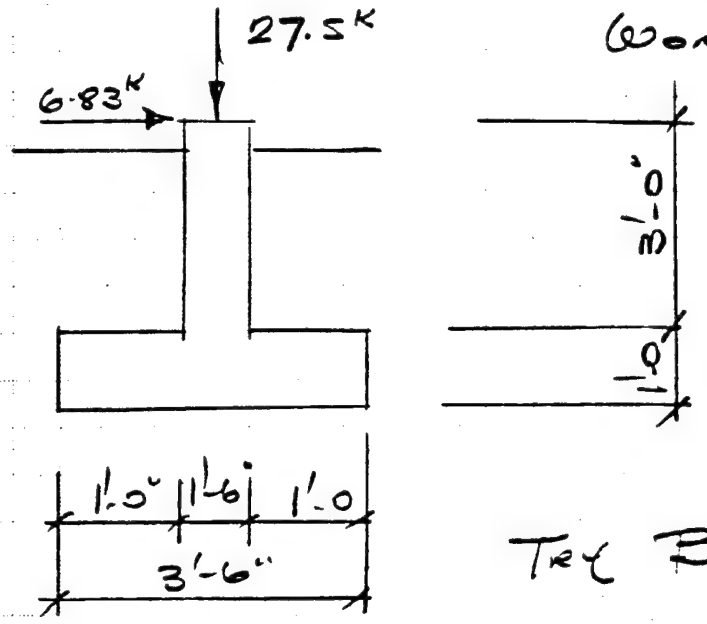
Stearns-Roger

PAGE 5

JOE NO 26616 DATE 7-2-82 BY GW CH'K

CUSTOMER R.M.A. PROJECT GROUND WATER TREATMENT

SUBJECT BUILDING FOUNDATIONS



Worst Case

Try Base 3'-6" x 3'-6"
= 12.25 sq ft

Pier = 1.5 x 1.5 x 3 x 0.15 = 1.0125 x 1.75 = 1.77
Slab = 3.5 x 3.5 x 1.0 x 0.15 = 1.8375 x 1.75 = 3.22
Soil = $(3.5^2 - 1.5^2)$ x 2.5 x 0.1 = 2.5 x 1.75 = 4.375
P = 27.5 x 1.75 = 48.125

Σw = 32.85 K. ΣM^o = 57.49 K ft

Mot = 6.83 x 4.0 = 27.32 K ft.

$\bar{X} = \frac{57.49 - 27.32}{32.85} = 0.918$ ft < 1.17

$e = \frac{3.5}{2} - 0.918 = 0.832$ ft.

$I = \frac{3.5 \times 3.5^3}{12} = 12.5$ ins^4

$P = \frac{32.85}{12.25} \pm \frac{32.85 \times 0.832 \times 1.75}{12.5}$

$= 2.68 \pm 3.826$ > 3. ksf

Try 5'-0" Square

JOB NO. 26616 DATE 7-2-82 BY GFW CH'K

CUSTOMER R.M.A. PROJECT GROUND WATER TREATMENT

SUBJECT BUILDING FOUNDATIONS

Pier = $1.5 \times 1.5 \times 3 \times 0.15 = 1.0125 \times 2.5 = 2.53$

Slab = $5.0 \times 5.0 \times 1.0 \times 0.15 = 3.75 \times 2.5 = 9.375$

Soil = $(5.0^2 - 1.5^2) \times 3 \times 0.1 = 6.825 \times 2.5 = 17.063$

P $= 27.5 \times 2.5 = 68.75$

$\Sigma W = 39.1^K$ $\Sigma MR = 97.72^{K-ft}$

$M_{OT} = 6.83 \times 4 = 27.32^{K-ft}$

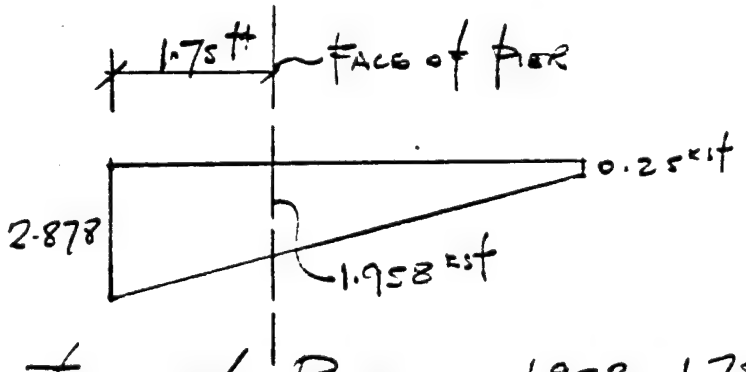
$\bar{X} = \dfrac{97.72 - 27.32}{39.1} = 1.8$ ft

$e = \dfrac{5.0}{2} - 1.8 = 0.7$ ft

$I = \dfrac{5.0 \times 5.0^3}{12} = 52.08 \text{ ins}^4$

$P = \dfrac{39.1}{25.0} \pm \dfrac{39.1 \times 0.7 \times 2.5}{52.08}$

$= 1.564 \pm 1.314 = +2.878^{Ksf} < 3.0$
$+ 0.25^{Ksf}$



BM @ Face of Pier $= \dfrac{1.958 \times 1.75^2}{2} + \dfrac{0.92 \times 1.75^2 \times 0.66}{2}$

$= 3.0 + 1.0 = 4.0^{K-ft}$

$A_s = \dfrac{M}{ad} = \dfrac{4.0}{1.76 \times 9} = 0.25 \square''$

Min $A_s = 12 \times 12 \times 0.002 = 0.288 \square''$

USE #5 @ 12" C-C BOTH WAYS IN SLAB.

JOB NO. 26616 DATE 7-6-82 BY GW CH'K

CUSTOMER R.M.A. PROJECT GROUND WATER TREATMENT

SUBJECT BUILDING FOUNDATIONS

PICK REINFORCING.

$BM = 6.83 \times 3.0 = 20.49^{K}ft$

$A_s = \frac{20.49}{1.76 \times 13.5} = 0.862\ in^2$

USE 2 - #6 $A_s = 0.88^{\square}$

So USE 4 - #6 IN PIERS WITH #3 TIES AT 12" CENTERS.

CORNER COLS WILL HAVE 1/2 ROOF LOAD & 1/2 WIND LOAD. BUT WILL HAVE ADDITIONAL SIDING LOAD.

So HORIZONTAL FROM WIND = $6.83/2 = \underline{3.42^{K}}$

VERTICAL : SIDING = $10 \times 5 \times 30 = 1.5^{K}$

$+ 3.75/2 = 1.875^{K}$

FROM ROOF = $25.0/2 = 12.5^{K}$

$+ 5.0^{K}$ CONTINGENCY $= 5.0$

20.875^{K} TOTAL VERT

SAY $\underline{21.0^{K}}$

TRY 3'-6" SQ BASE (Pg 5)

PIER = $1.5 \times 1.5 \times 3 - 0.15$	$= 1.0125$	$\times 1.75$	$= 1.77$
SLAB = $3.5 \times 3.5 - 1.0 \times 0.15$	$= 1.8375$	$\times 1.75$	$= 3.22$
SOIL = $(3.5^2 - 1.5^2) \times 2.5 \times 0.1$	$= 2.5$	$\times 1.75$	$= 4.375$
P =	21.0	$\times 1.75$	$= 36.75$
	$\Sigma W = \underline{26.38^{K}}$		$\Sigma M = \underline{46.115^{K}ft}$

$MOT = 3.42 \times 4.0 = 13.68^{K}ft$

JOB NO. 26616 DATE 7-6-82 BY GW CH'K.
CUSTOMER R.M.A PROJECT GROUND WATER TREATMENT
SUBJECT BUILDING FOUNDATIONS

CORNER COLS (CONT).

$\bar{X} = \frac{46.11 - 13.68}{26.38} = 1.23$ ft.

$e = \frac{3.5}{2} - 1.23 = 0.52$ ft

$I = 12.5$ ins^4

$P = \frac{26.38}{12.25} \pm \frac{26.38 \times 0.52 \times 1.75}{12.5}$

$2.15 \pm 1.92 = 4.07 > 3.0$

FOR PRELIMINARY DESIGN
USE 4'-0" SQ WITH #5 @ 12" CRS BOTH WAYS
USE SAME FOR PIER 1'-6" SQUARE
4-#6 & #3 TIES.

EQUIPMENT FOUNDATIONS

WITH EQUIPMENT BEING INSIDE BUILDING SEISMIC WILL CONTROL DESIGN of FOUNDATION
ADSORBERS W = 140^K EACH, 9'-0"ϕ, 23'-0" HIGH

$V = ZKCW$
$= 0.25 \times 2.0 \times 0.1 \times 140 = 7.0^K$

$OTM = 7.0 \times 11.5 = 80.5^{K}$ ft

RESISTING MOMENT $= 140 \times 4.5 = 630^{K}$ ft
+ BASE WEIGHT $= 9.0 \times 9.0 \times 0.83 \times 0.15$
$= 10.12^K \times 4.5 = 45.5^{K}$ ft

JOB NO. 26616 DATE 7-6-82 BY GLO CH'K

CUSTOMER RMA PROJECT GROUND WATER TREATMENT

SUBJECT FOUNDATIONS.

ADSORBERS (CONT).

$$\bar{X} = \frac{675.5 - 80.5}{150.12} = 3.96 \text{ ft}$$

$$e = \frac{9.0}{2} - 3.96 = 0.54 \text{ ft}$$

$$I = \frac{9.0 \times 9.0^3}{12} = 546.75 \text{ ins}^4$$

$$P = \frac{150.12}{81} \pm \frac{150.12 \times 0.54 \times 4.5}{546.75}$$

$$= 1.853 \pm 0.667 = + 2.52 \text{ ksf}$$
$$+ 1.186 \text{ ksf}$$
$$\text{OK} < 3.0 \text{ ksf}$$

$$\text{Min } A_s = 12 \times 10 \times 0.002$$
$$= 0.24 \text{ Sq ins}$$

Use # 4 @ 9" crs ($A_s = 0.27$)
BOTH WAYS IN BOTTOM.

BY INSPECTION OF ALL EQUIPMENT LOADS AND SIZE OF FOUNDATIONS, USE TYE ABOVE FOR ALL LARGE FOUNDATIONS

USE 1'-3 THICK SLAB + 2" GROUT ALLOWANCE UNDER ALL LARGE EQUIPMENT FOUND'S TO ALLOW FOR 1" ϕ ANCHOR BOLT PULL OUT CAPACITY & EMBEDMENT LENGTH OF 12"
FOR FLOOR SLAB 6" THICK REINFORCED WITH ONE LAYER WWF 4 x 4 - W4.0 x W4.0

FORM 62-114
REV. 4-75

Stearns-Roger

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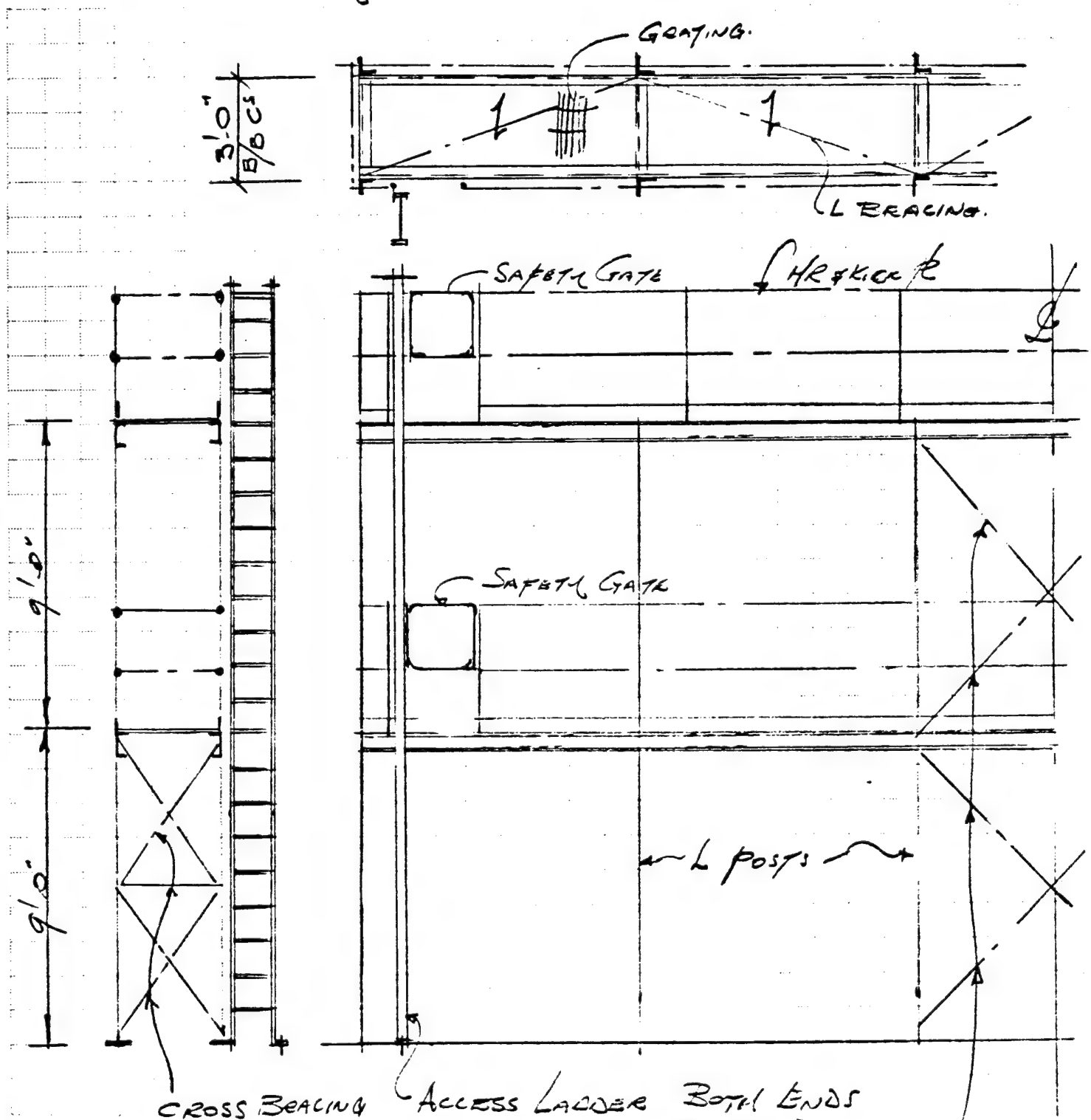
JOB NO. 26616 DATE 7-6-82 BY GW CH'K

CUSTOMER R.M.A. PROJECT GROUND WATER TREATMENT

SUBJECT WALKWAY ACCESS TO ADSORBERS.



FORM 62-114
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Stearns-Roger

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JOB NO. 26616 DATE 7-8-82 BY TKO CH'K. JMC

CUSTOMER ROCKY MTN ARSENAL PROJECT RAW WATER TREATMENT FACILITY

SUBJECT TOILET ROOM

VENTILATION

SIZE OF ROOM 6'W x 8'L x 9'H → FROM ARCH.

MIN. VENTILATION = 10 AC/HR. PER TM5-810-1 PG. 22

VOLUME OF ROOM = (6')(8')(9') = 432 FT³

∴ MIN CFM = $(432\,FT^3)\left(\frac{10}{HR}\right)\left(\frac{HR}{60\,MIN}\right)$ = 72 CFM

COST OF FAN FROM MEAD 1982 PG 226 ⇒ #63.00
INSTALLATION = 1 M.H.

20 FT DUCTWORK @ .166/FT ⇒ COST = #3.20
INSTALLATION ⇒ .03 M.H./FT
TOTAL = 1 M.H.

WALL GRILLE → 6"x6" COST = #5.00
LABOR = 1M.H.

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Stearns-Roger

PAGE 2

JOB NO. 26616 DATE 7-8-82 BY _____ CH'K. JMC

CUSTOMER _____ PROJECT _____

SUBJECT Toilet Room

HEATING

Two Outside Walls > $U = .15 \frac{BTUH}{°F \cdot FT^2}$

Area Wall 1 $8' W \times 8' H = 64 FT^2$
Wall 2 $6' W \times 8' H = 48 FT^2$

Total Area $= 112 FT^2$

Design Temp From TM5-810-1, Pg 1, Temp = 60°F
From TM5-785 Winter Design Dry-Bulb ⇒ 97.5% : 1°F
∴ $\Delta T = 1°F$

∴ $\Delta T = 60 - 1 = 59°F$

∴ $Q = (U)(A)(\Delta T) = (.15)(112)(59)$
$Q_{Outside} = 990 BTUH$

Estimate U Value of Internal Walls & Ceiling = $.30 \frac{BTUH}{°F \cdot FT^2}$
From ASHRAE 1981 Fundamentals Table 4C Pg 23.21

∴ Area of Walls = $112 FT^2$ Same As Exterior Walls
Area of Ceiling = $8' * 6' = 48 FT^2$

∴ Total Area = $160 FT^2$
$\Delta T = 60 - 40 = 20°F$

∴ $Q = UA\Delta T = (.3)(160)(20°F)$
$= 960 BTUH$

∴ Total Heat Need = 960 + 990 = 1950 BTUH ~ 2000 BTUH
~ 600 W

FORM 62-114
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Stearns-Roger

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JOB NO. _____ DATE _____ BY TKO CH'K. JMC

CUSTOMER _____ PROJECT _____

SUBJECT _____

DESIGN USING INFRARED HEATING.
FOR A DAYTON 550 W, GRANGER STOCK # 5H374
PRICE = $47.00
120V
THERMOSTAT ⇒ $40

USING A GENERAL ELECTRIC GH500 T3 500W INCANDESCENT LIGHT WITH A RECESSED FIXTURE. PRICE = $K.00.
USE A THERMOSTAT = $40.00
TO BE ESTIMATED BY ELECTRICAL.

FORM 62.114
REV. 4 75

Stearns-Roger

PAGE 1

JOB NO. 26616 DATE 7-1-82 BY TKO CH'K JMC

CUSTOMER ROCKY MTN. ARSENAL PROJECT RAW WATER TREATMENT FACILITY

SUBJECT HEAT LOAD CALC.

ASSUME U VALUES:

WALL = .15 $\frac{BTUH}{F\text{-}FT^2}$
ROOF = .10 $\frac{BTU}{°F\text{-}FT^2}$
} REF DCD. 4270.1-M TABLE 9.2

DESIGN INTERIOR TEMP = 40°F, REF: DCD 4270.1-M, CH. 9-2.1

CALC. OF HEAT LOAD.:

REF.: ASHRAE FUNDAMENTALS '1981 - 25.2

$Q = UA \times TD$

WINTER DESIGN DRY-BULB → 97.5% = 1°F TM5-785

$\therefore TD = 40 - 1 = 39°F$

FROM ARCH. DWG. ROOF AREA = (40 FT)(73 FT) = 2920 FT²

WALL AREA = 30FT(2(40FT) + 2(73FT)) = 6780FT²

$Q = UA\,\Delta T \Rightarrow$

Q WALL = (.15)(6780)(39) = 39700 BTUH
Q ROOF = (.10)(2920)(39) = 11400 BTUH
51100 BTUH

TOTAL HEAT LOAD FOR WINTER = 51100 BTUH DUE TO TRANSMISSION HEAT LOSS

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JOB NO. _____ DATE _____ BY TKO CH'K. JHL

CUSTOMER _____ PROJECT _____

SUBJECT _____

PER ASHRAE CH 22.8 ESTIMATE 1 A.C./HR. DUE TO INFILTRATION

$\therefore$ VOLUME OF AIR $\Rightarrow$ (30)(40)(73) = 87600 FT^3

$\therefore Q = (1.08)(.825)(CFM)(\Delta T)$

$= (1.08)(.825)(87600)(t_o)(40-1)$

$= 50800$ BTUH

$\therefore$ HEAT LOAD DUE TO INFILTRATION = 50800 BTUH

HEAT LOAD THRU SLAB $\Rightarrow$ ASHRAE 1981 FUNDAMENTALS $\Rightarrow$ 25.8 $\rightarrow$ 25.9

$$Q = F_2 P (T_i - T_o)$$

EST. FOR A METAL STUD WALL WITH INSULATION $F_2 = .53$

P = PERIMETER OF BLDG = (2)(40')+2(73')=226 FT

$\therefore Q = (.53)(226)(40-1) = 4670$ BTUH

$\therefore$ HEAT LOAD DUE TO FLOOR SLAB = 4670

$\therefore$ TOTAL DESIGN HEAT LOAD = 51100
50800
4670
106570 BTUH

ADD 15% SAFETY FACTOR $\Rightarrow$ (1.15)(106570) BTUH = 122560 BTUH

FORM 62-114
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Stearns-Roger

JOB NO. _____ DATE _____ BY TKO CH'K. JMC

CUSTOMER _____ PROJECT _____

SUBJECT _____

HEATING LOAD = 122,560 BTUH

USE 4 MODINE PA-50 HEATERS
RATED: INPUT 50,000 BTUH
OUTPUT: 40,000 BTUH

DERATED: INPUT (.84)(50,000) = 42,000 BTUH
OUTPUT: (.84)(40,000) = 33,600 BTUH

TOTAL CAPACITY: INPUT: (4)(42,000) = 168,000 BTUH
OUTPUT: (4)(33,600) = 134,400 BTUH

HEAT THROW (FT): 23

PROPANE: 20 CFH EA. OR 80 CFH TOTAL

COST FOR UNIT HEATER: $420.00 EA WITH INTERMITTENT PILOT
LABOR: 16 M.H. TOTAL
COST FOR 5" DIA. VENT CHIMNEY: 5" DIA → 100 FT
MATERIAL: $2.50 L.F → $250.00
LABOR: 25 M.H. .25MH/L.F.

THERMOSTATS B-C TA-121 MATERIAL $55 EA.

PIPING: 3/4" → 200' TOTAL PIPING
50' UNDERGROUND ⇒ 16 M.H. + TRENCHER
150' HUNG ⇒ 24 M.H.

MATERIAL $1.00 LF → $200
FITTINGS → $200

FORM 62-114
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Stearns-Roger

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JOB NO. 26616 DATE 7-7-82 BY TKO CH'K. JMC

CUSTOMER ROCKY MTN. ARSENAL PROJECT RAW WATER TREATMENT FACILITY

SUBJECT CALC. OF PROPANE USAGE

REF. HEAT LOAD CALCULATIONS.

$\therefore Q_{WALL} = (.15)(6780)(\Delta T) = (1017)(\Delta T)$

$Q_{ROOF} = (.10)(2920)(\Delta T) = (292)(\Delta T)$

$Q_{TRANSMISSION} = (1017+292)(\Delta T) = (1309)(\Delta T)$

$Q_{INFILTRATION} = (1.08)(.825)(87600)(1/60)(\Delta T)$

$= (1301)(\Delta T)$

$Q_{SLAB} = (.53)(226)(\Delta T) = (120)(\Delta T)$

$\therefore Q_{TOTAL} = (1.15)(1309+1301+120)(\Delta T)$

$= (3140)(\Delta T)$

REF. ASHRAE SYSTEMS 43.12 FOR DENVER AREA

OUTDOOR TEMP	HRS	BTUH @ 1°F	ΔT < 40°F	BTUH HEAT LOSS	TOTAL BTU
37	717	3140	3	9420	6754140
32	721		8	25120	18111520
27	553		13	40820	22573460
22	359		18	56520	20290680
17	216		23	72220	15599520
12	119		28	87920	10462480
7	78		33	103620	8082360
2	36		38	119320	4295520
-3	22		43	135020	2970440
-8	6		48	150720	904320
-13	1		53	166420	166420
-18	1		58	182120	182120
TOTAL					110392980 BTU

ASSUME 80% EFFICIENCY ON HEATERS → $\frac{110392980}{.80} = 137,911,230$ BTU

$\frac{92000 \text{ BTU}}{\text{GAL. PROPANE}} \Rightarrow \text{GAL PROPANE} = \frac{137911230}{92000} = 1500 \text{ GAL}$

$\therefore$ DESIGN YEARLY USE OF PROPANE = 1500 GAL

FORM 62.114
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Stearns-Roger

JOB NO. 26616 DATE 7-7-82 BY TKO CH'K. JAC

CUSTOMER _____ PROJECT _____

SUBJECT _____

∴ SIZE FOR 1000 GAL PROPANE TANK TO BE FILLED MONTHLY IN THE WINTER

COST OF TANK : #1500.00
REGULATING VALVE : #50.00

MUST INSTALL TANK 25FT MIN FROM BLDG.

INSTALLATION: 16 M.H.

HANGERS FOR THE HEATERS → #20.00 FOR EA. HEATER
TOTAL COST = #80.00

ISOLATION VALVES FOR HEATERS AND REGULATOR, ∴ 10 VALVES #10 00 EA.

VENT CAP @ #20 EA ∴ #80.00

FORM 62-114
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Stearns-Roger

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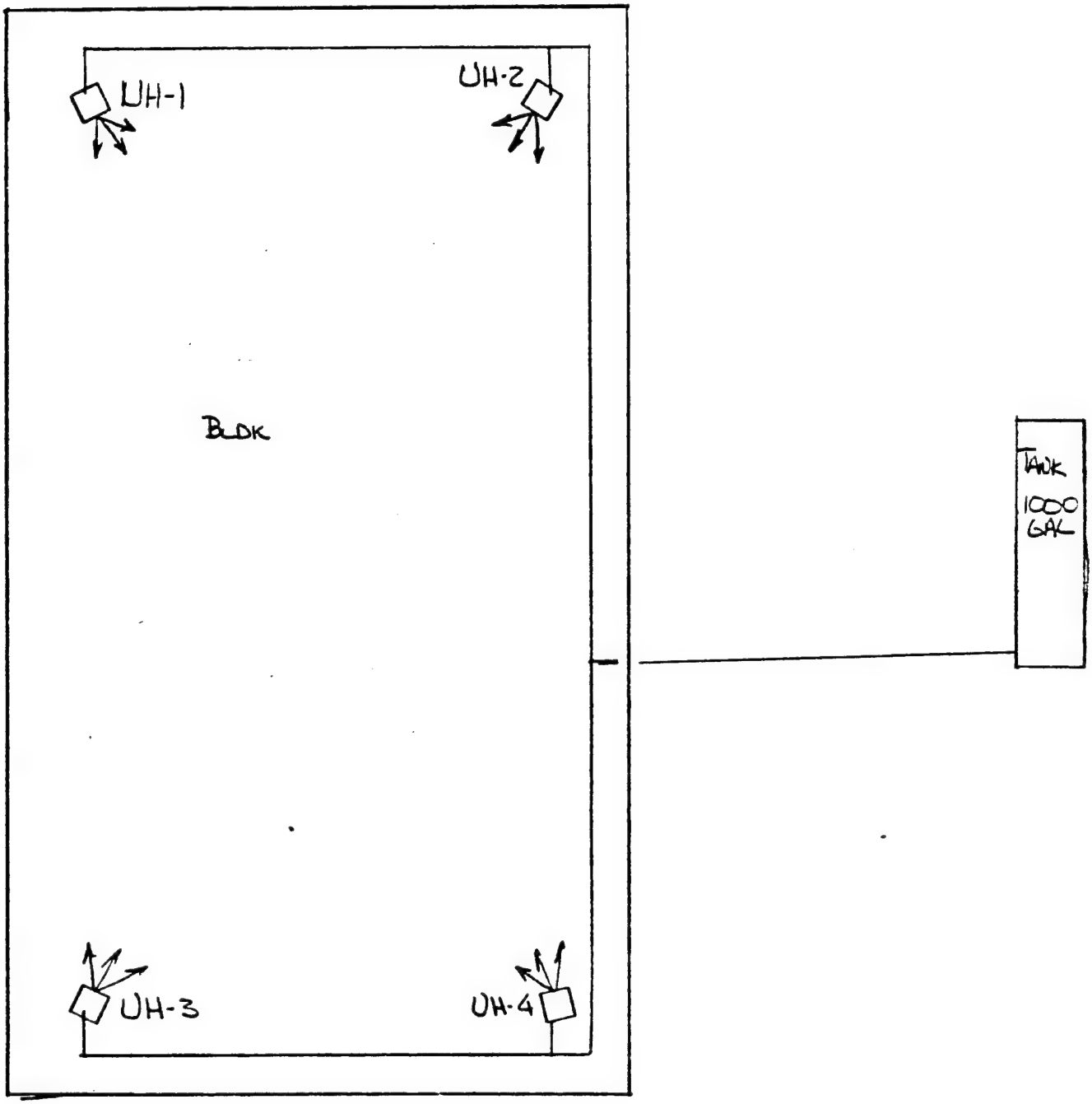
JOB NO. _____ DATE _____ BY TKC CH'K. JMC

CUSTOMER _____ PROJECT _____

SUBJECT _____



FORM 62-114
REV. 4-75

Stearns-Roger

JOB NO. 26616 DATE 7-7-82 BY TKO CH'K. JMC

CUSTOMER ROCKY MTN. ARSENAL PROJECT RAW WATER TREATMENT FAC

SUBJECT COOLING LOAD

ASHRAE FUND. 1981 PG. 26.3 $Q = U * A * CLTD$

COOLING LOAD DUE TO ROOF

$U = .10 \frac{BTUH}{°F\ FT^2}$ DOD 4270.1-M TABLE 9.2

$A = (40')(75') = 3000 FT^2$

$CLTD \Rightarrow$ ASHRAE, FUND., PG. 26.8

TABLE 5A $CLTD = 79°F$ @ 14:00

PG. 26.8 $CLTD_{CORR} = [(CLTD + LM)K + (78 - T_R) + (T_o - 85)] * f$

WHERE $T_{ROOM} = 102°F$ EQUIPMENT MAX. TEMP.

$T_{OUTSIDE} = 91°F$ 97.5% SUMMER DRY BULB TMS-785

$f = 1.0$ NO ATTIC

$LM = 2$ FROM TABLE 9A

$K = 1.0$ INDUSTRIAL AREA

$\therefore CLTD_{CORR} = (79 + 2) + (78 - 102) + (91 - 85)$

$= 63°F$

$\therefore Q_{ROOF} = (.10)(3000)(63) = 18900 BTUH$

COOLING LOAD DUE TO WALLS

$U = .15 \frac{BTUH}{°F\ FT^2}$ DOD 4270.1-M TABLE 9.2

AREAS OF WALL →

NORTH AREA = $A_N = (40')(30') = 1200 FT^2$

SOUTH AREA = $A_S = (40')(30') = 1200 FT^2$

EAST AREA = $A_E = (75')(30') = 2250 FT^2$

WEST AREA = $A_W = (75')(30') = 2250 FT^2$

FROM TABLE 6 GROUP B WALL

$\therefore$ FROM TABLE 7A :

NORTH WALL @ 2:00 $CLTD_N = 9°F$

SOUTH WALL @ 2:00 $CLTD_S = 12°F$

EAST WALL @ 2:00 $CLTD_E = 22°F$

WEST WALL @ 2:00 $CLTD_W = 14°F$

PG. 26.12 $\Rightarrow CLTD_{CORR} = (CLTD + LM) \times K + (78 - T_R) + (T_o - 85)$

· SAME DESIGN CONDITIONS AS ABOVE

FORM 62-114
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Stearns-Roger

JOB NO. 26616 DATE 4-7-82 BY TKO CH'K. JMC

CUSTOMER _____ PROJECT _____

SUBJECT _____

$CLTD_{CORR_N} = (9+1)(1.0) + (78-102) + (91-85)$
$= -8°F$

$CLTD_{CORR_S} = (12-1) + (78-102) + (91-85)$
$= -7°F$

$CLTD_{CORR_E} = (22+1) + (78-102) + (91-85)$
$= 5°F$

$CLTD_{CORR_W} = (14+1) + (78-102) + (91-85)$
$= -3°F$

$\therefore Q_{NORTH\ WALL} = (.15)(1200)(-8) = -1440\ BTUH = Q_{NW}$
$Q_{SOUTH\ WALL} = (.15)(1200)(-7) = -1200\ BTUH = Q_{SW}$
$Q_{EAST\ WALL} = (.15)(2250)(5) = 1690\ BTUH = Q_{EW}$
$Q_{WEST\ WALL} = (.15)(2250)(-3) = -1010\ BTUH = Q_{WW}$

$\therefore$ TOTAL Q FROM WALLS $\Rightarrow Q_W = Q_{NW} + Q_{SW} + Q_{EW} + Q_{WW}$
$= -1440 - 1260 + 1690 - 1010$
$Q_W = -2020\ BTUH$

$\therefore$ TOTAL TRANSMISSION GAIN $= Q_{ROOF} + Q_{WALL} = 18900 + (-2020)$
$\therefore Q_T = 15180\ BTUH$

ESTIMATE LIGHT LOAD = $1\ W/FT^2$
USE INCANDESCENT LIGHTS
AREA = $(40')(75') = 3000\ FT^2$
$Q_L = (1\ W/FT^2)(3000\ FT^2)(3.4\ BTUH/W)$
$Q_L = 10200\ BTUH$

FORM 62-114
REV. 4-75

Stearns-Roger

JCB NO. 26616 DATE 7-7-82 BY TKO CH'K. JMC

CUSTOMER _____ PROJECT _____

SUBJECT _____

ESTIMATE EQUIPMENT, PUMP & AIR COMPRESSOR MOTOR LOADS TO BE 20 H.P. TOTAL. FROM ASHRAE 1981 FUNDAMENTALS TABLE 24 PG. 26.29 MOTOR IN, DRIVEN EQUIPMENT OUT OF THE AIR STREAM:

$Q_M = 7610$ BTUH

PERSONNEL LOAD

FROM ASHRAE 1981 FUND., TABLE 18, PG. 26.25 LIGHT BENCH WORK, MALE

$Q_P = 880$ BTUH

∴ TOTAL DESIGN HEAT LOAD IN THE BLDG.

15180 BTUH → TRANSMISSION
10200 BTUH → LIGHTING
7610 BTUH → MOTORS
880 BTUH → PERSONNEL

$Q_{TOTAL} = 33870$ BTUH

ADD 20% SAFETY FACTOR

∴ $Q_{TOTAL} = (1.2)(33870) = 40650$ BTUH

DESIGN FOR A ROOM TEMP. = 102°F
OUTSIDE AIR TEMP. = 91°F
∴ $\Delta T = 11$°F

∴ AMOUNT OF VENTILATION AIR ⇒

$$CFM = \frac{Q}{(1.08)(.825)(\Delta T)} = \frac{40650}{(1.08)(.825)(11)}$$

CFM = 4150

FORM 62-114
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Stearns-Roger

JOB NO. 26616 DATE 7-7-82 BY IKO CH'K. JMC

CUSTOMER _____ PROJECT _____

SUBJECT _____

ACCORDING TO TM5-810-1 PG. 20 DESIGN USING GRAVITY AIR MOVERS WITH MANUAL SHUT OFF DAMPERS BASED ON A WIND VELOCITY OF 4 MPH.

DESIGN FOR A STACK HEIGHT OF 30 FT AND A TEMP. DIFF. OF 10°F.

∴ DESIGN USING A PENN FAN-AIR RIDGE GRAVITY ROOF VENTILATOR AT DESIGN CONDITIONS ⇒ 359 $\frac{CFM}{FT^2}$ OPENING

∴ OPEN AREA NEEDED = $\frac{4150 CFM}{359 CFM/FT^2} = 11.6 FT^2$

FROM PERFORMANCE TABLE A 12.00 X 10 FT LONG UNIT HAS A CAPACITY OF 2620 CFM. THEREFORE 2 UNITS ARE NEEDED.

COST OF EACH UNIT IS $400.00.

DESIGNED AROUND ARMCO. INFORMATION ON UNITS ARE NOT GIVEN. SINCE LOUVERS ARE NOT INSTALLED FOR MAKE-UP AIR AND THE EFFICIENCY OF ARMCO GRAVITY AIR MOVERS IS UNKNOWN SEE FOR THREE UNITS AT 12 IN. WIDE X 10 FT LONG.

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REV. 4 75

Stearns-Roger

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JOB NO. C-26616 DATE 7-8-82 BY WEW CHK

CUSTOMER COE - RMA SUBJECT N.W. BOUNDARY CONTAIN./TREAT. SYS

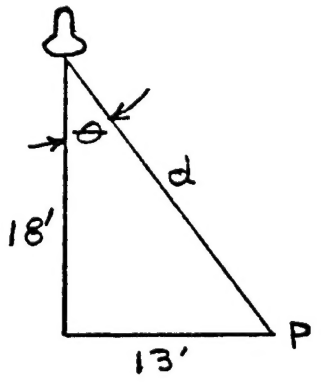
SUBJECT CONCEPT LIGHTING CALC. - BLDG. INTERIOR

BLDG. INTERIOR DIMENSIONS (APPROX)

75 FT x 39 FT x 29 FT HIGH

FIXTURE TYPE: PRISMATIC GLASS REFLECTOR
MFR.: HOLOPHANE
CAT. NO.: 1938
LAMP: 150 W HPS
MTG. HT.: 18 FT

FOOTCANDLE CALCULATION AT 13 FT FROM 0° (NADIR) ——



$\tan\theta = \frac{13}{18}$, $\theta = 35.84°$

$d = \sqrt{13^2 + 18^2} = 22.2'$

$I \cong 5300$ (FROM PHOTOMETRIC TEST DATA)

$$E = \frac{I}{d^2} \cos\theta$$

$$= \frac{5300}{(22.2)^2} \cos 35.84° = 8.7 \text{ FC AT "P"}$$

USE 6 FIXTURES (2 ROWS OF 3 EACH)

THE CONTRIBUTION OF ILLUMINATION FROM 6 LTG. UNITS WILL INCREASE THE AVERAGE ILLUMINATION TO AN ESTIMATED 20 FC AT THE WORK PLANE.